Comparison of two different data digitization presented in E2254 and F0164

Svetlana Dunaeva

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Elastic and Inelastic Scattering of Deuterons from Be^9, C^{12}, N^{14} and O^{16} at 14 MeV

Dai-Ca NGUYEN

Institute for Chemical Research
Kyoto University, Kyoto

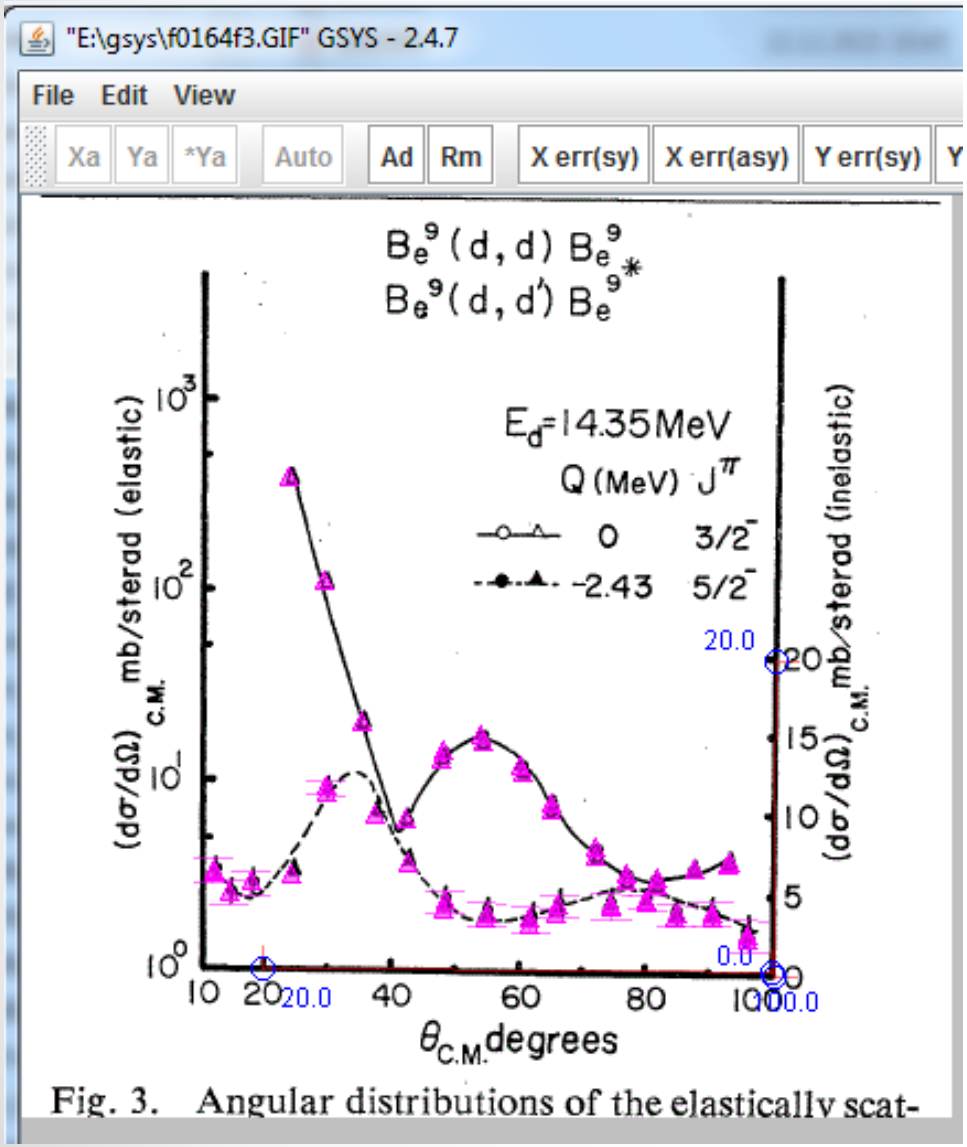
(Received August 1, 1966)

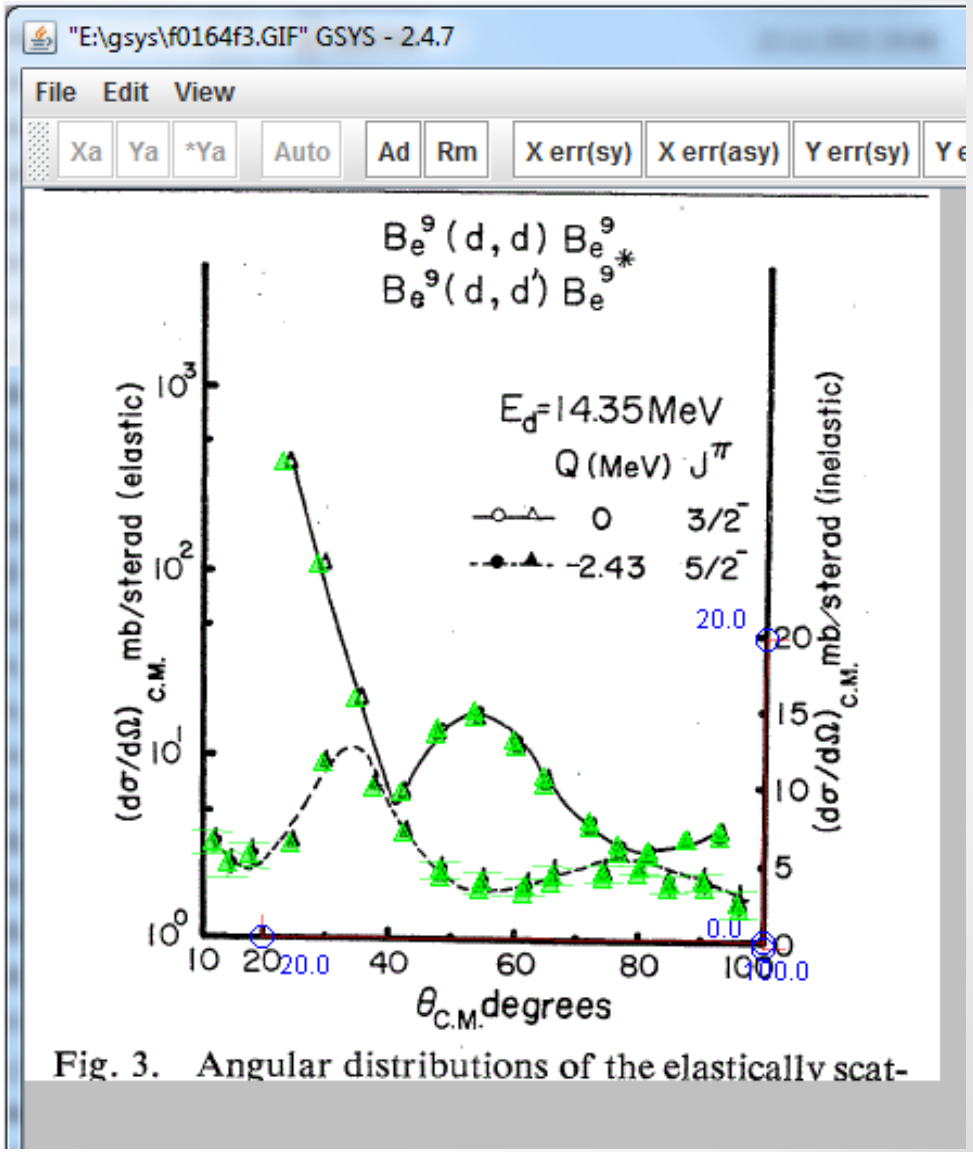
Angular distributions of the elastic and inelastic scatterings of deuterons from Be^9, C^{12}, N^{14} and O^{16} were measured by means of a broad range magnetic spectrograph with nuclear emulsion plates at intervals of 5° between 10° and 80° in the laboratory system. Deuterons leading to the 2.31 MeV $T=1$ state of N^{14} were not distinguished from the background so that the violation of the isobaric spin selection rule was not observed. For Be^9, the 2.43MeV $5/2^-$ rotational state was excited more strongly than the neighboring states. The 4.43MeV rotational state of C^{12} was also strongly excited. In the case of O^{16}, the 6.14MeV 3^- octupole vibrational state was resolved from the 6.06MeV 0^+ state and was found to be excited more strongly than the 6.06 MeV 0^+ state and also than the 6.92MeV 2^+ and 7.12MeV 1^- states. Comparison with the inelastic scattering data of protons and of alpha particles indicates that collective states which are excited strongly by protons and by alpha particles are also excited strongly by deuterons. Experimental angular distributions are compared with the predictions of the nuclear interaction theory of Huby and Newns and of the diffraction theory of Dar, and with the results from the DWBA analysis.

This article compiled in F0164 (CNPD) and E2254 (JCPRG)

Two digitization from E2254 (green points) and F0164 (magenta points) are presented on the following figs. Presentation was made using GSYS software.

magenta – F0164, green – E2254

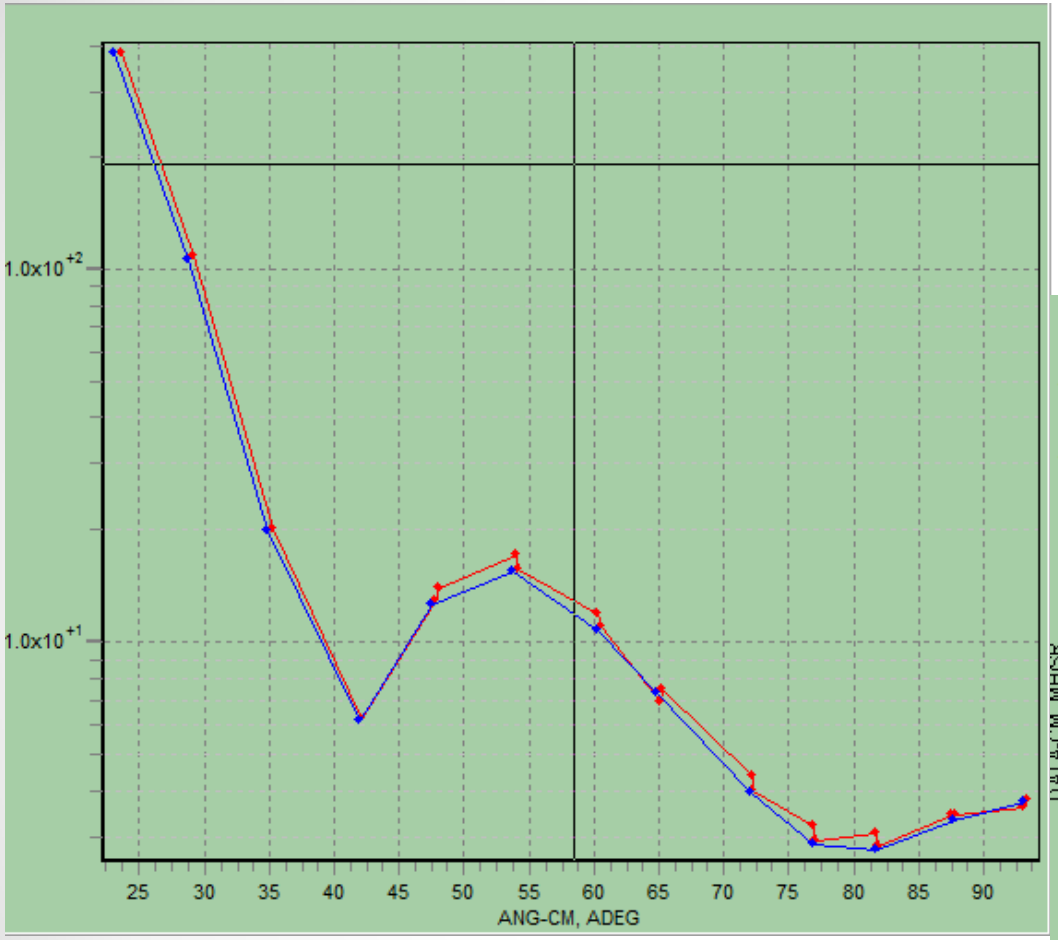




- Shift angular axes

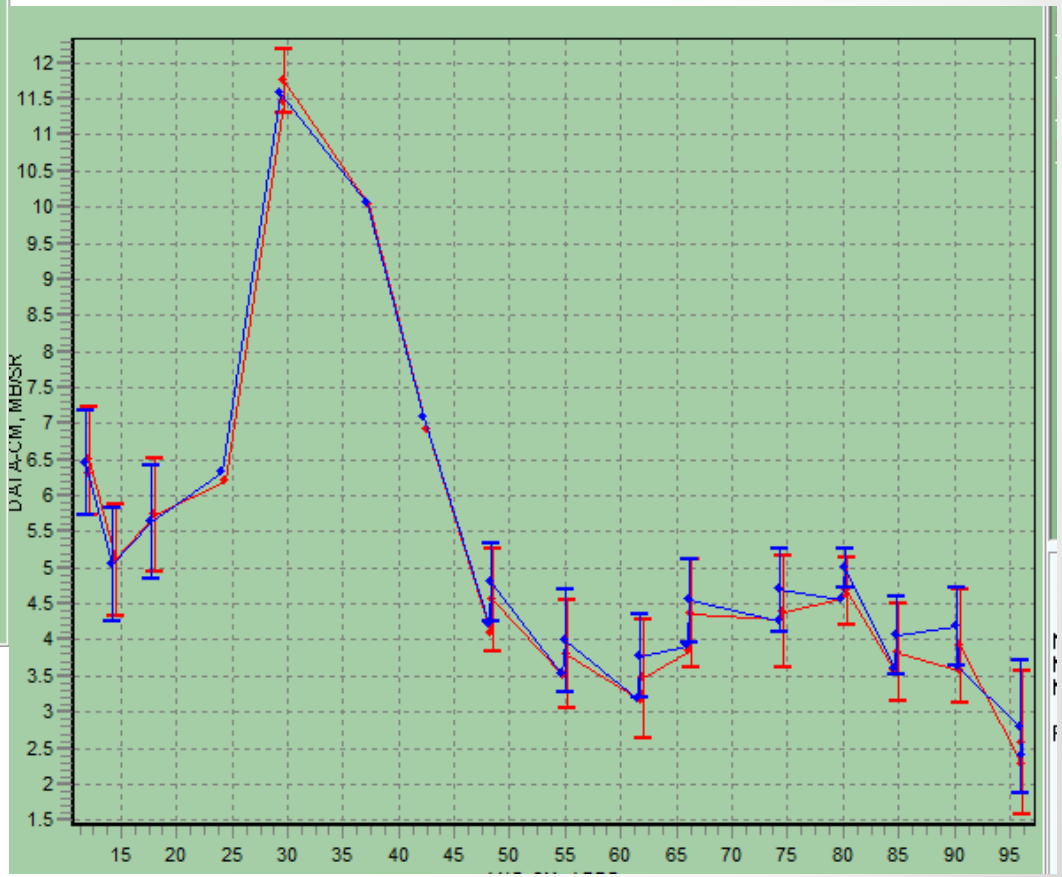
Same figs presented using ExforEditor

9Be(d,el), Fig.3



Red – F0164.002+014 and
Blue – E2254.002+003

9Be(d,inl), Fig.3



GSYS: magenta – F0164, green – E2254

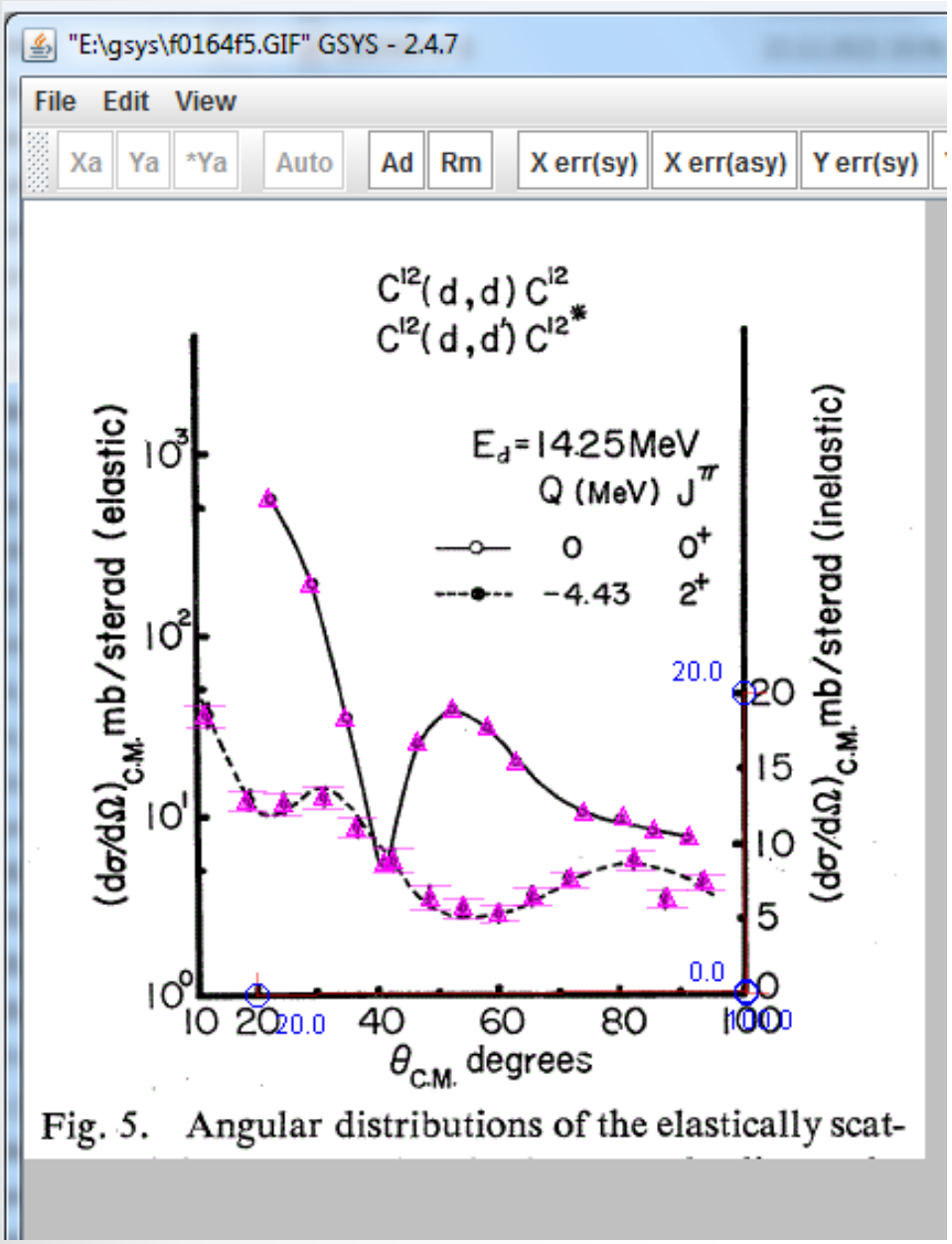


Fig. 5. Angular distributions of the elastically scat-

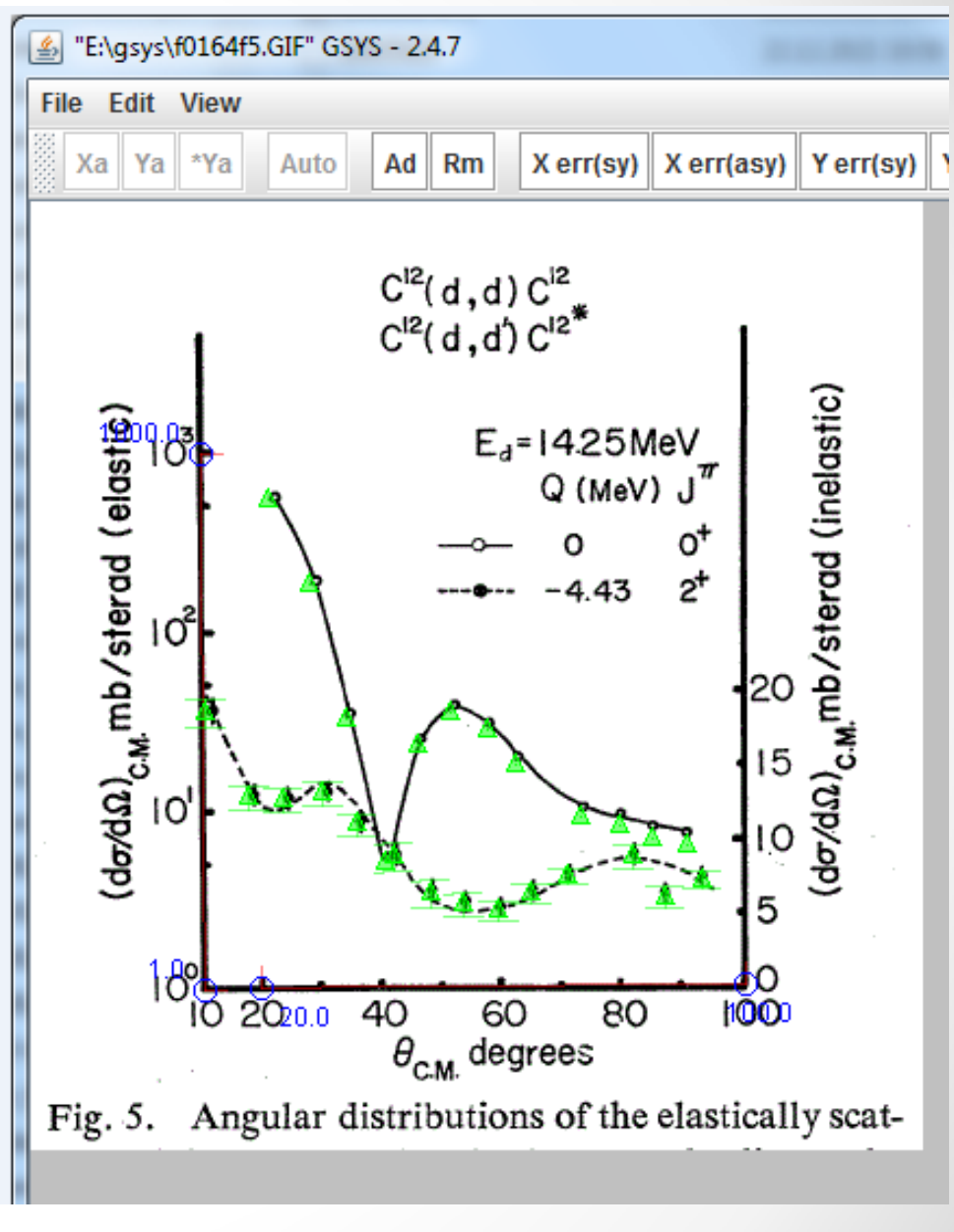
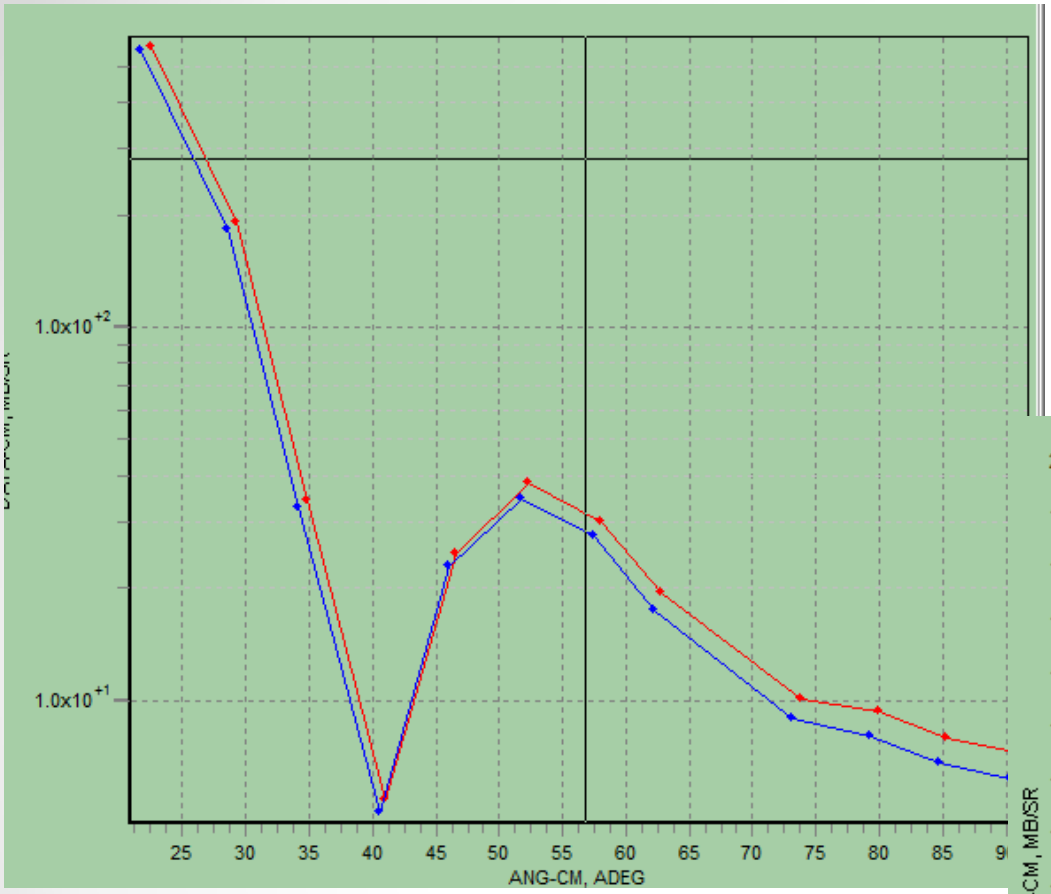


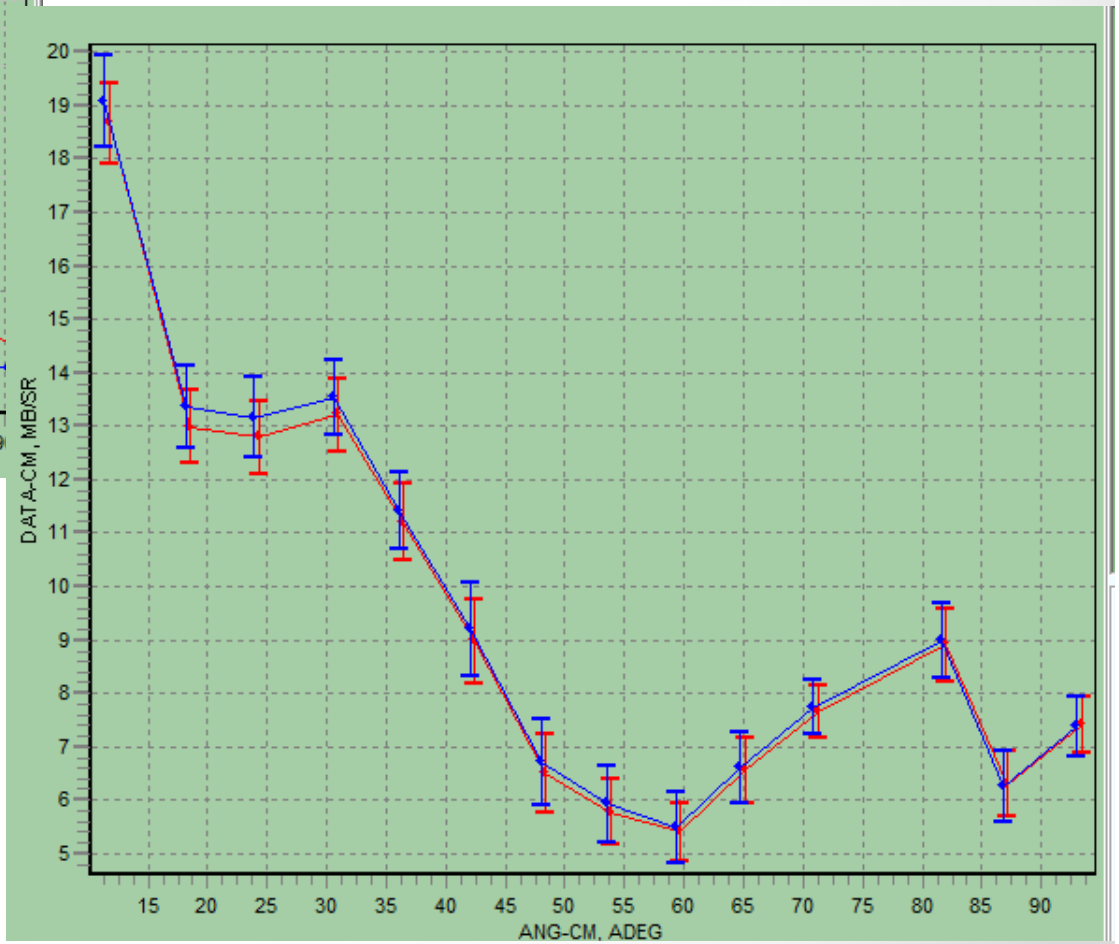
Fig. 5. Angular distributions of the elastically scat-

12C(d,el), fig.5

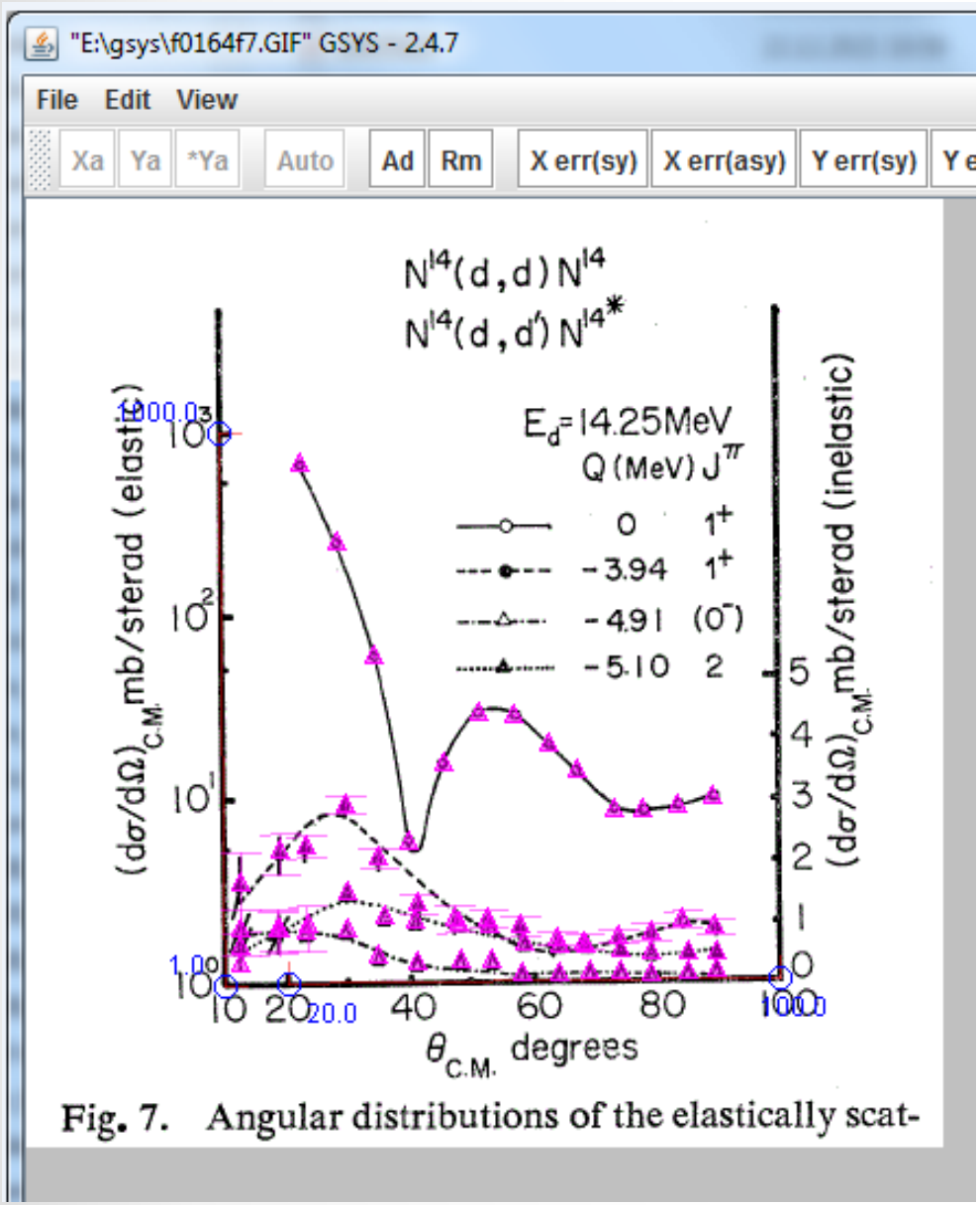
ExforEditor: Red – F0164
Blue – E2254

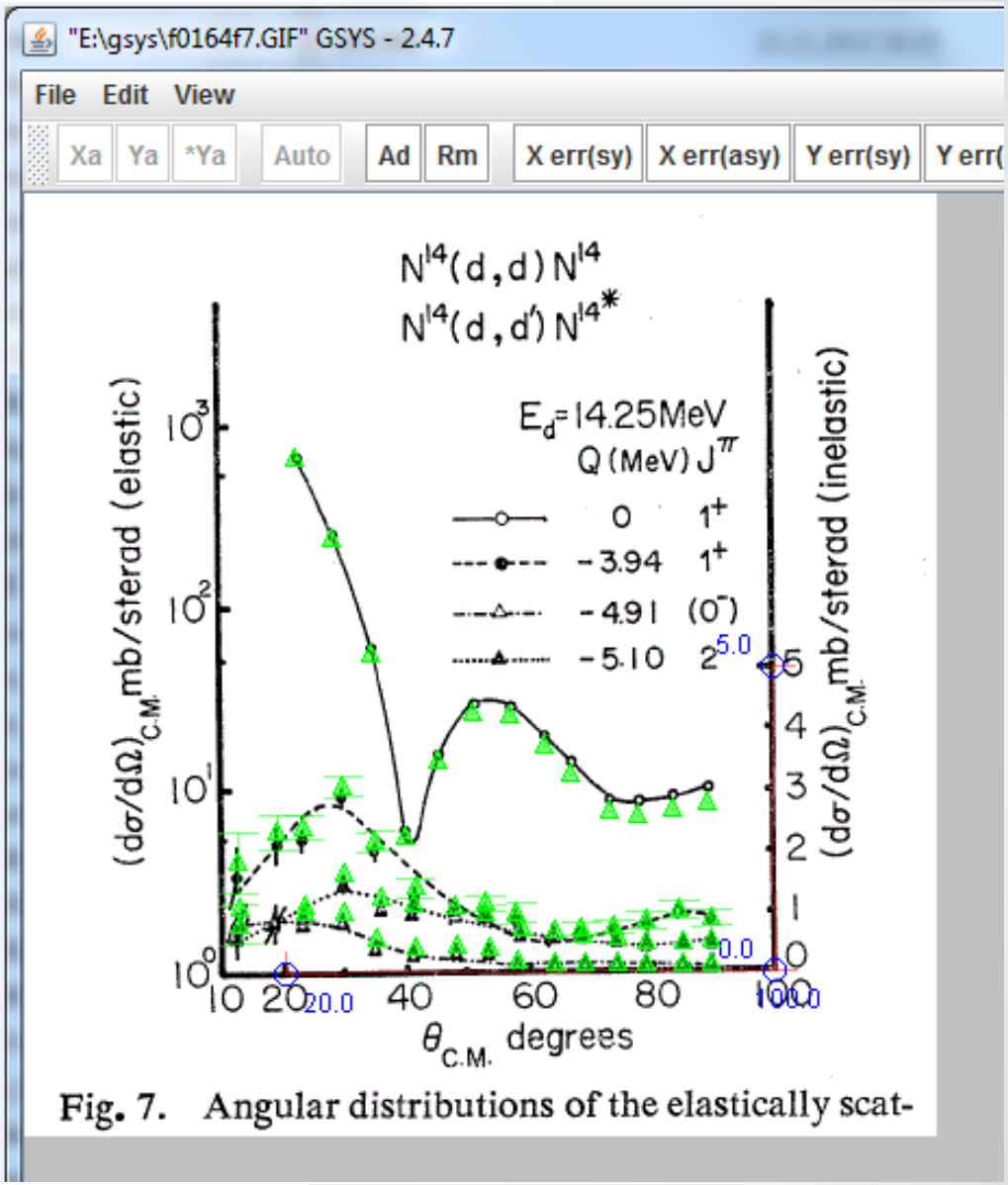


12C(d,inl), fig.5



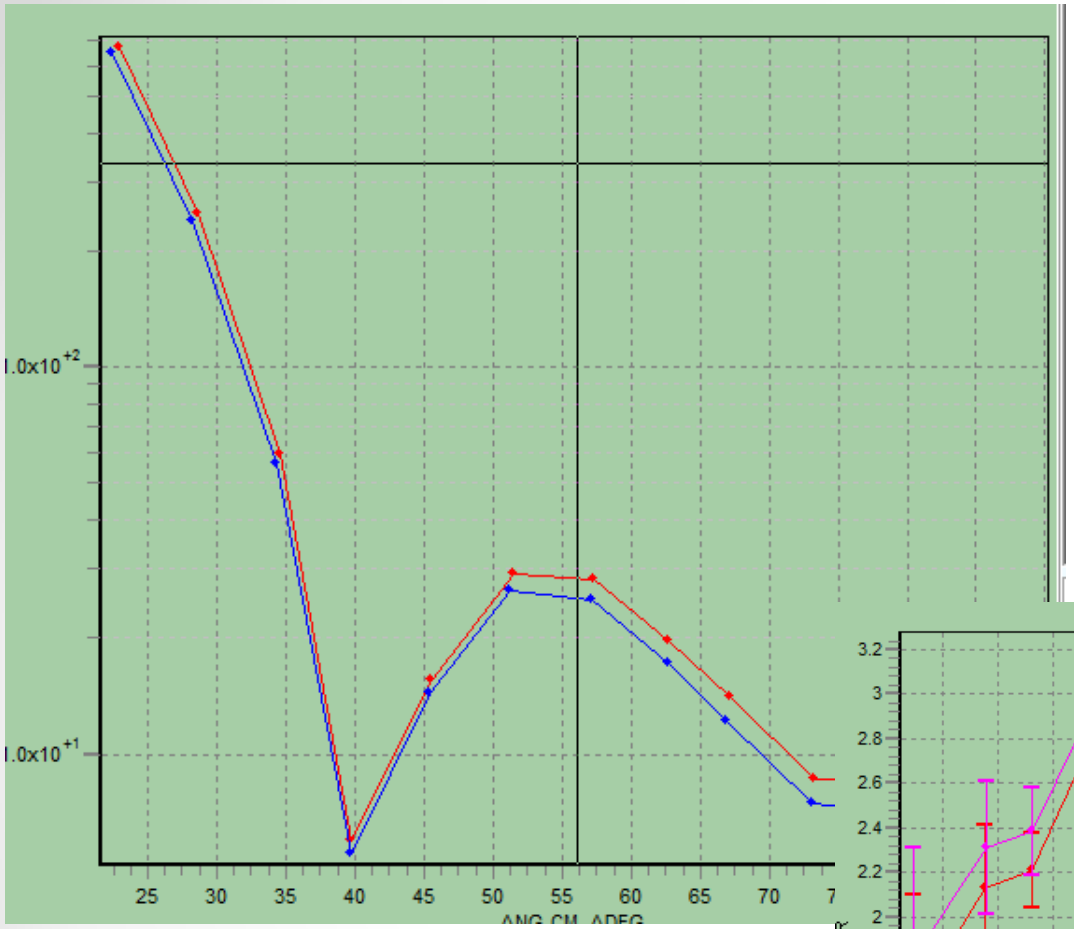
GSYS; magenta – F0164, green – E2254



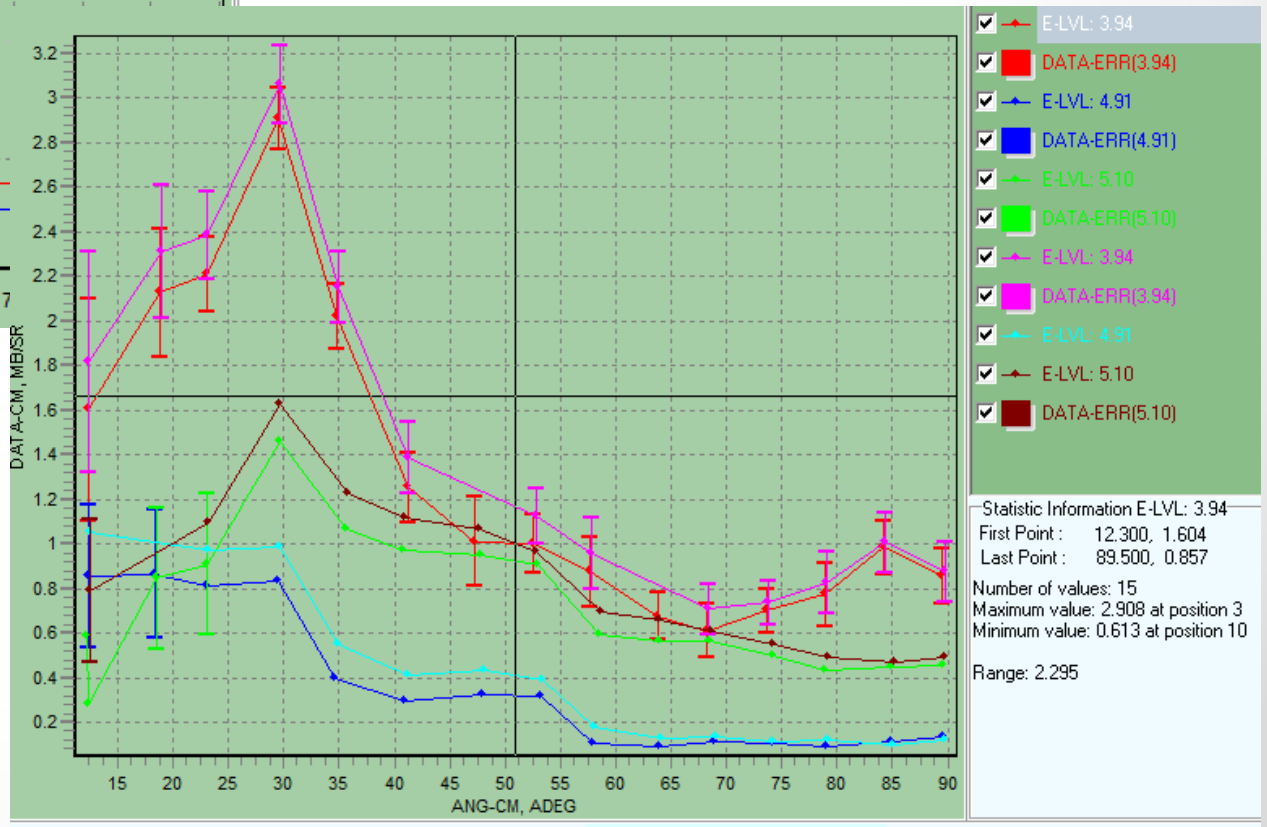


14N(d,el), fig.7

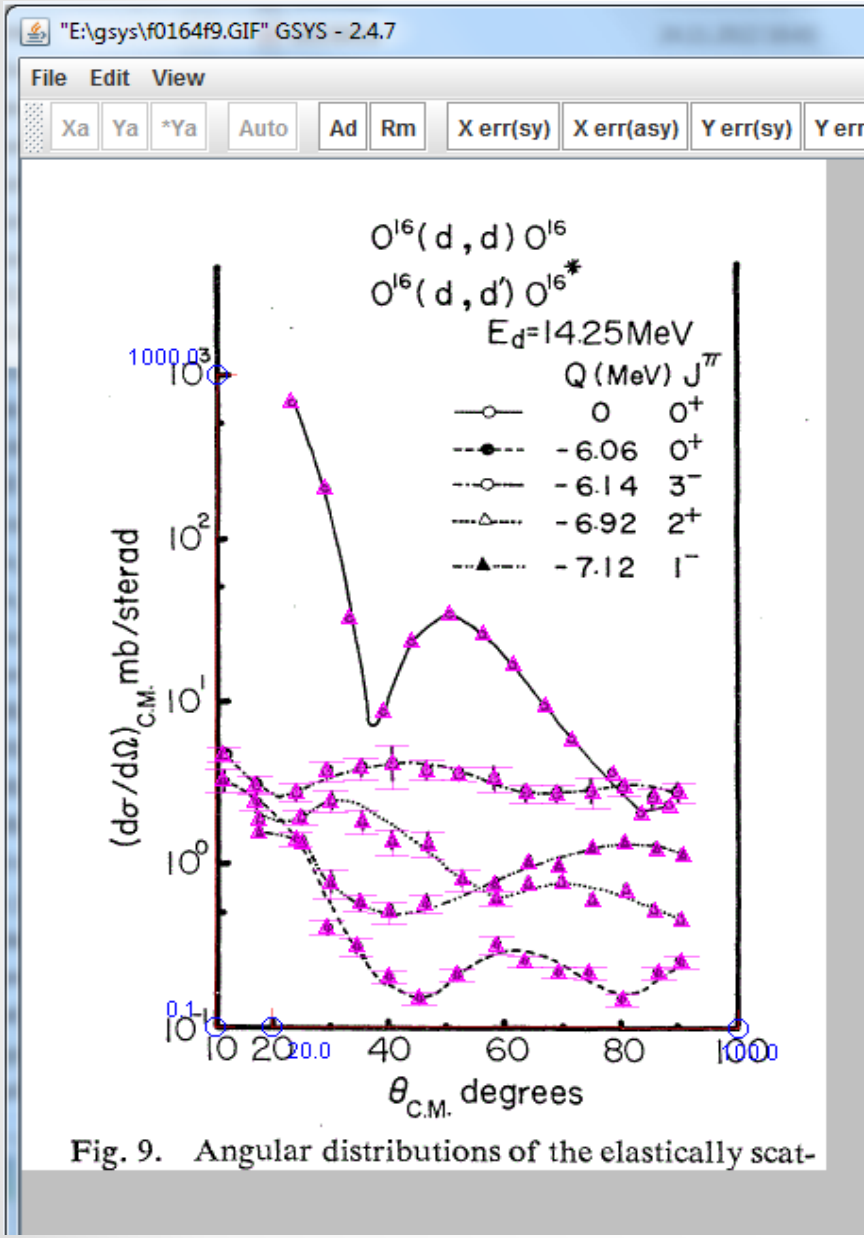
ExforEditor: Red – F0164
Blue – E2254

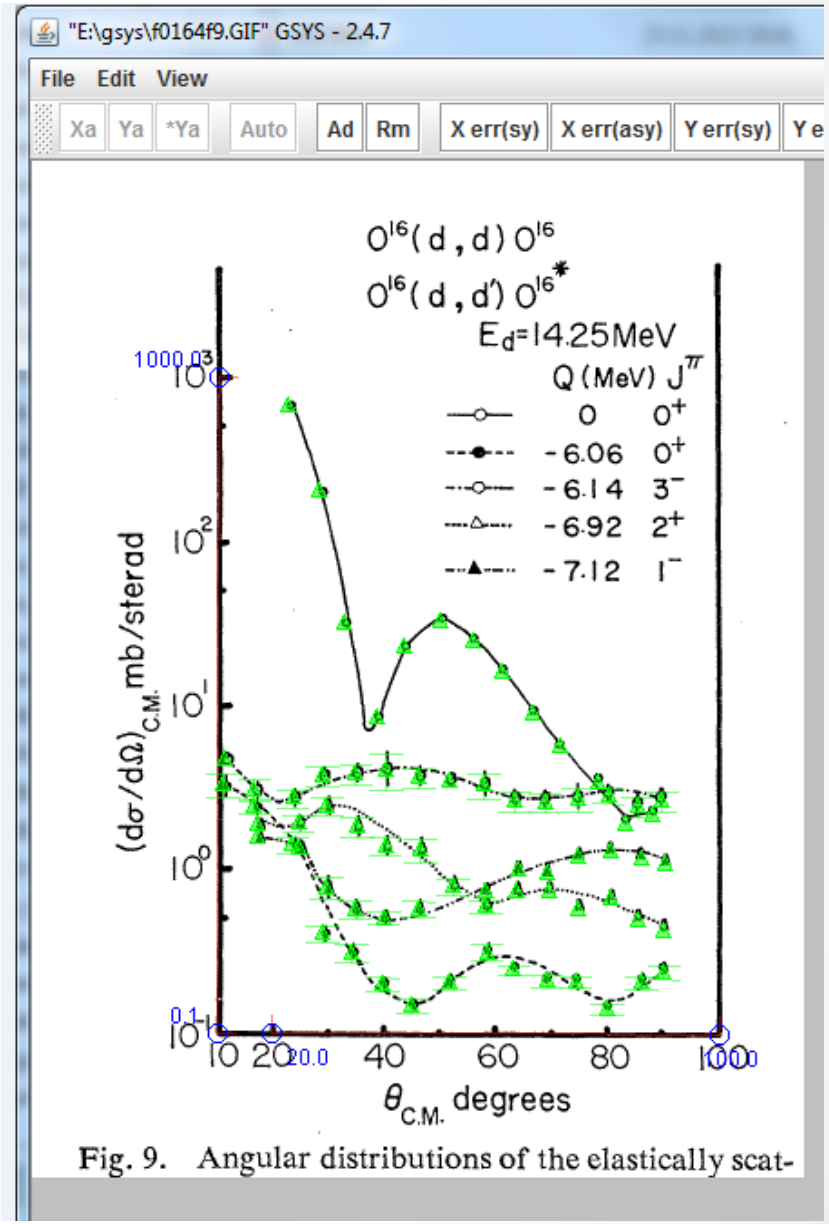


14N(d,inl), fig.7



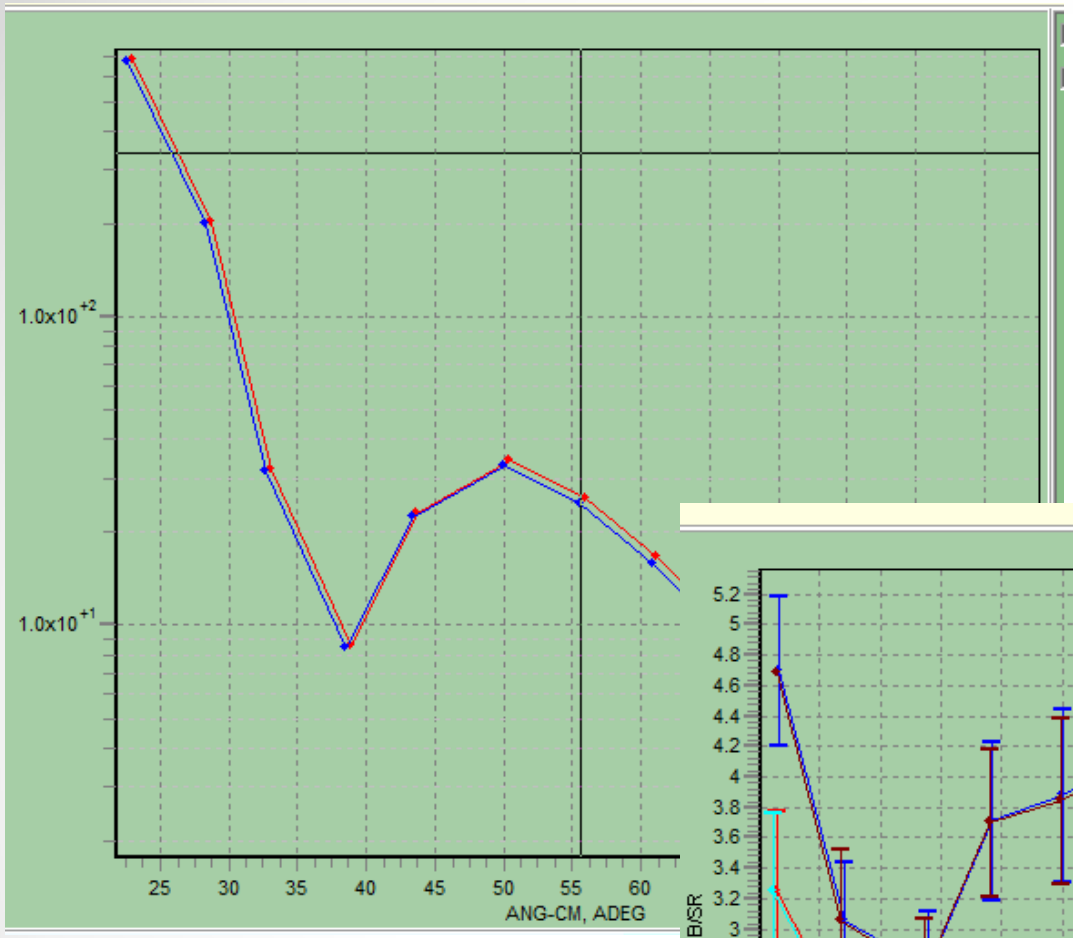
GSYS; magenta – F0164, green – E2254



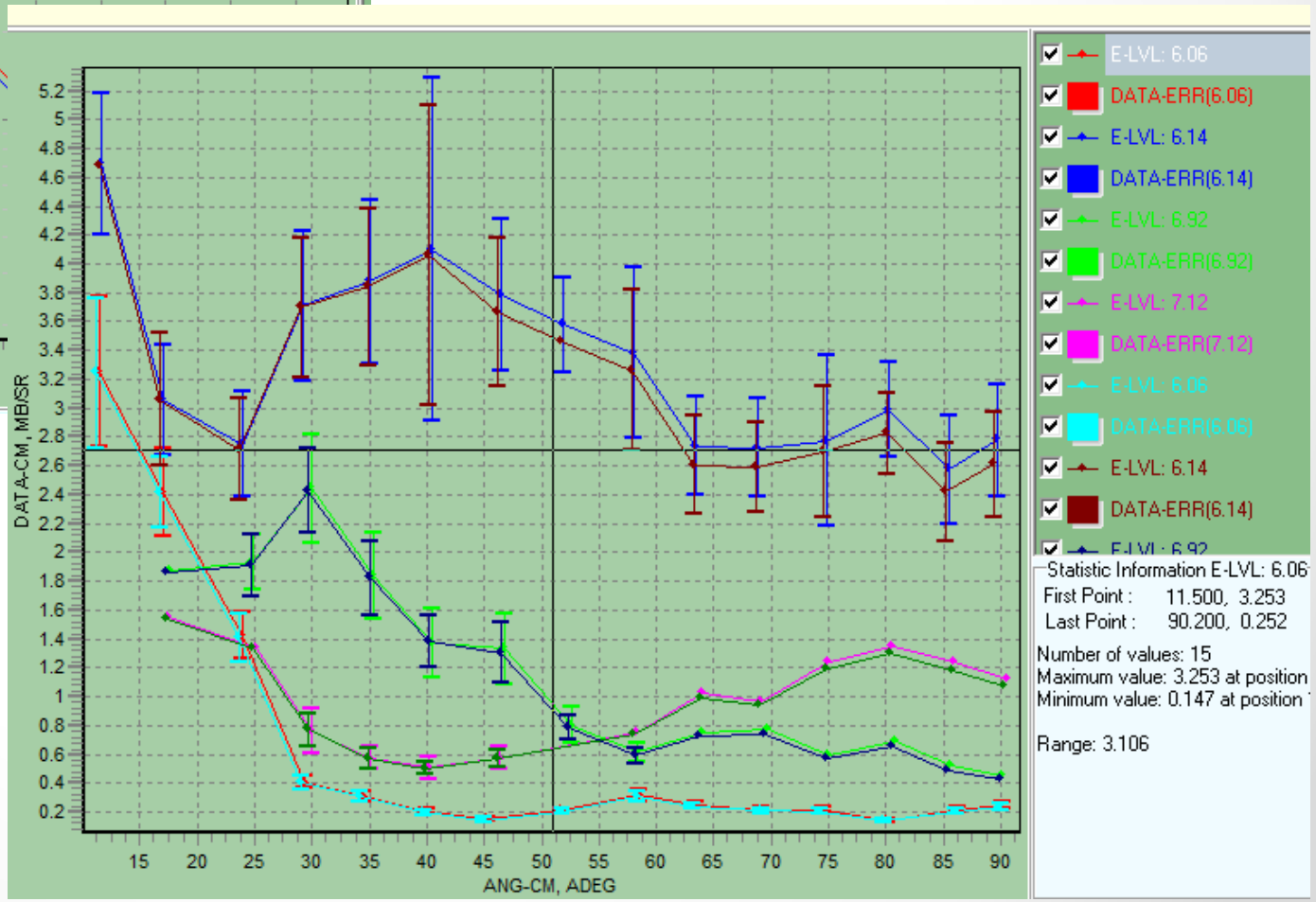


16O(d,el), fig.9

ExforEditor: Red – F0164
Blue – E2254



16O(d,inl), fig.9



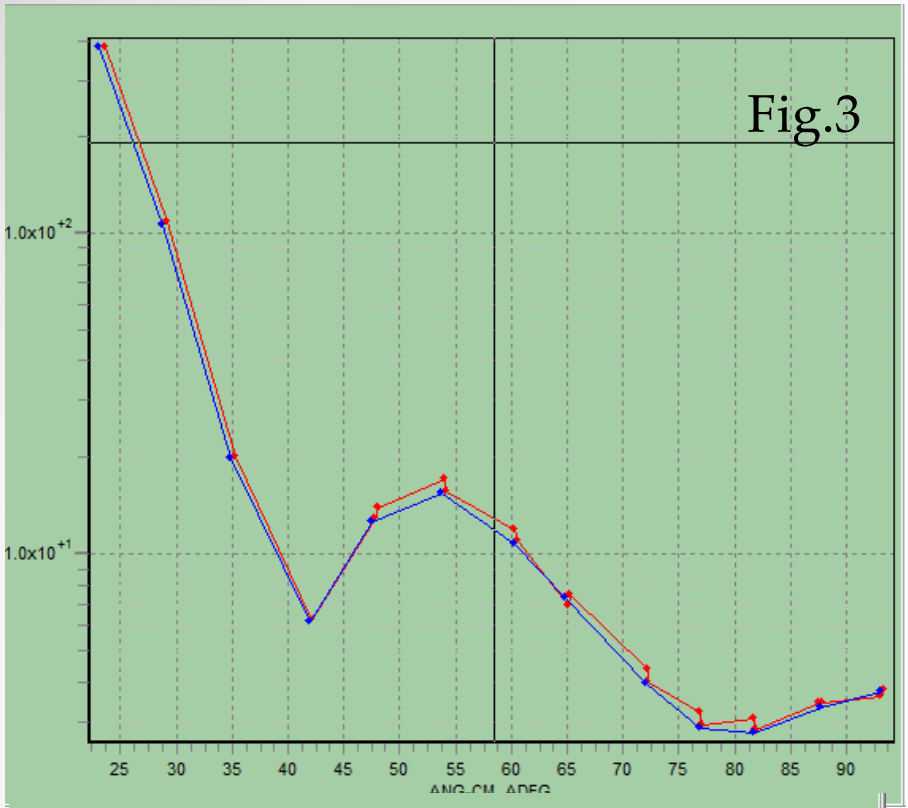


Fig.3
1.0x10+2
1.0x10+1
25 30 35 40 45 50 55 60 65 70 75 80 85 90

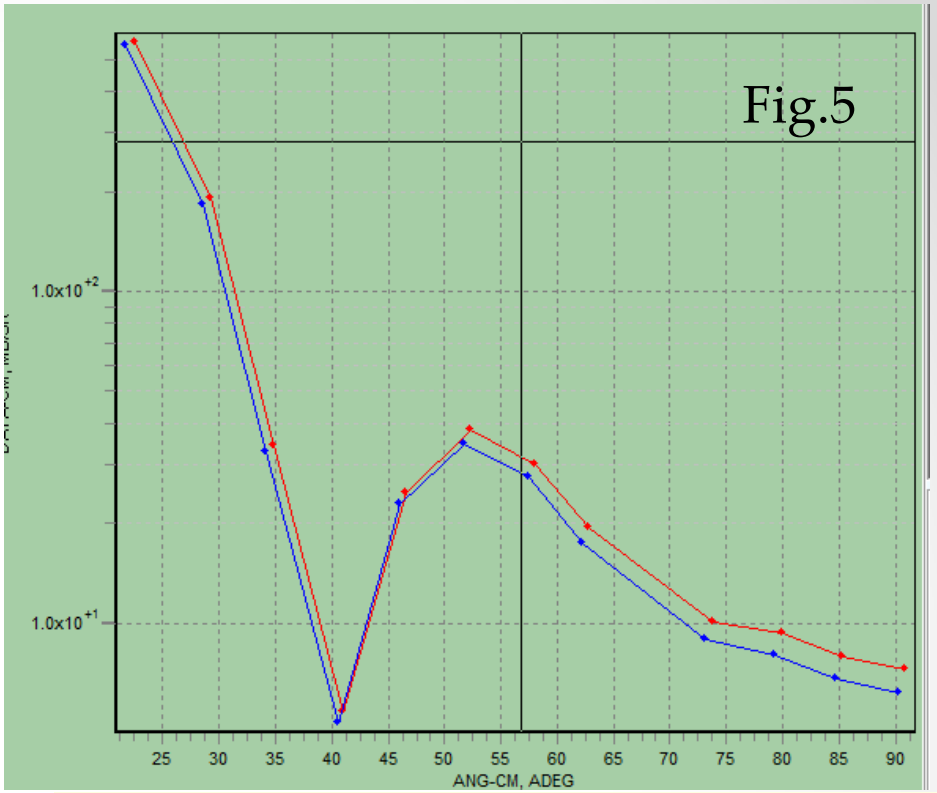


Fig.5
1.0x10+2
1.0x10+1
25 30 35 40 45 50 55 60 65 70 75 80 85 90
ANG-CM, ADEG

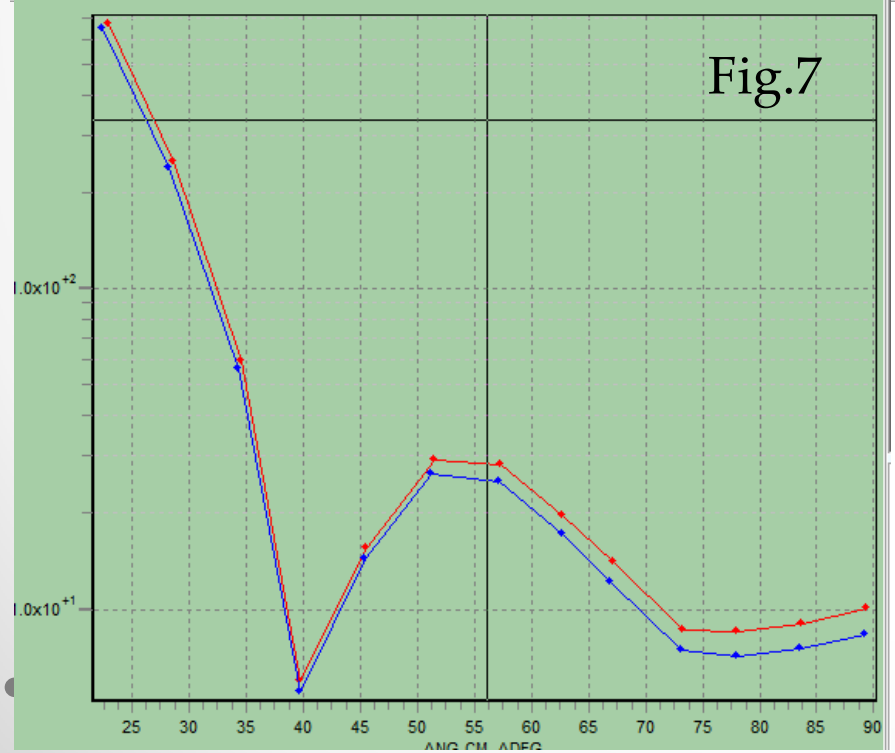


Fig.7
1.0x10+2
1.0x10+1
25 30 35 40 45 50 55 60 65 70 75 80 85 90

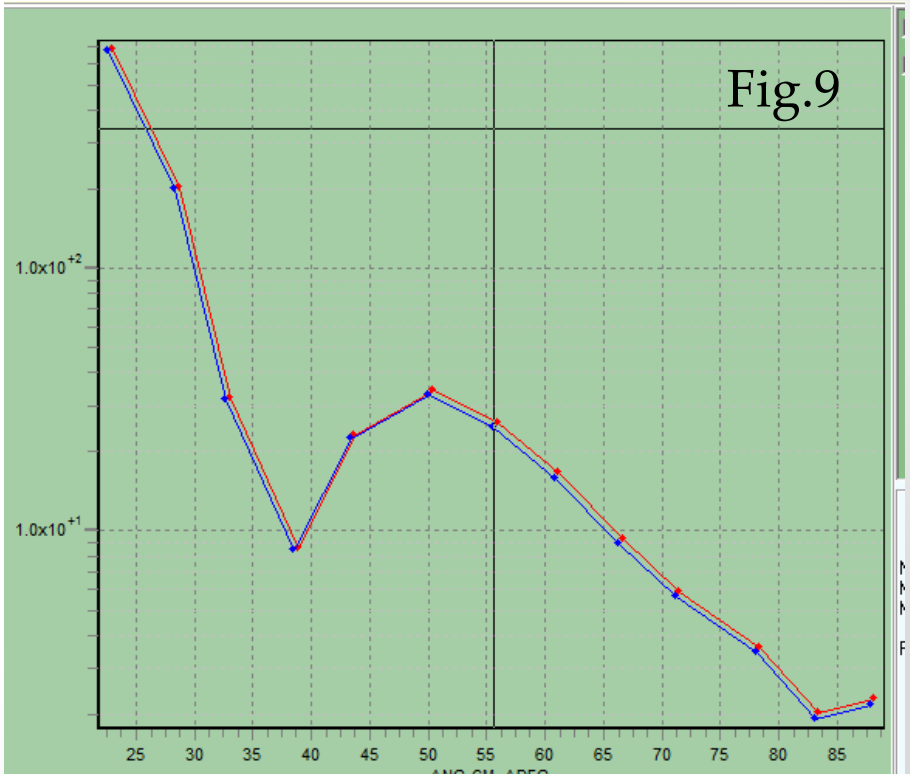


Fig.9
1.0x10+2
1.0x10+1
25 30 35 40 45 50 55 60 65 70 75 80 85

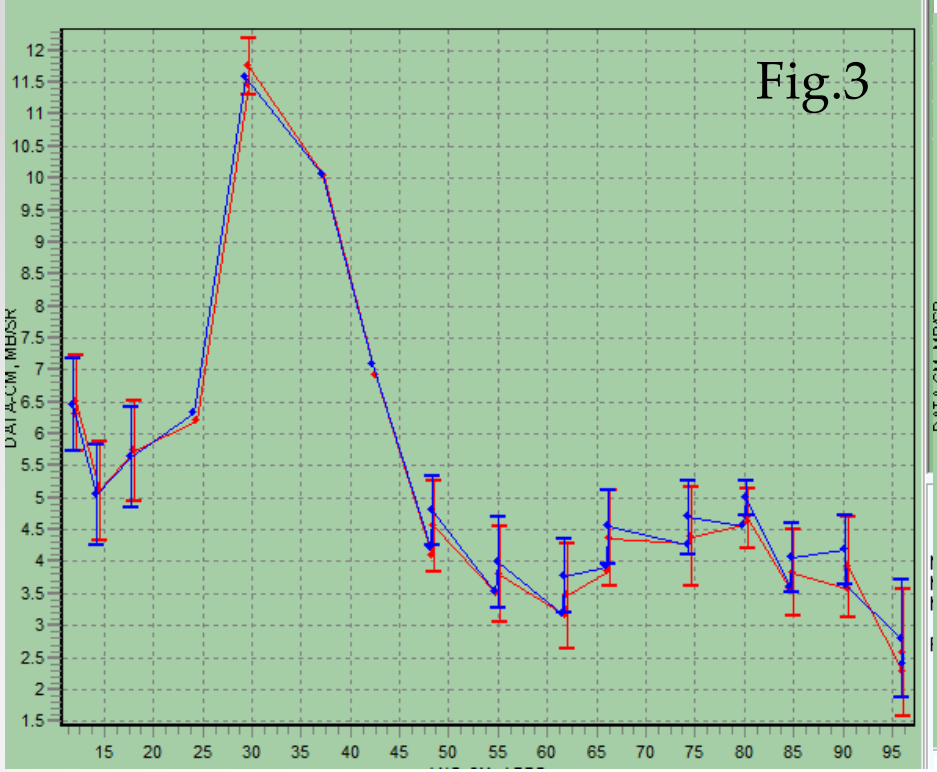


Fig.3
DATA-CM, MB/SR

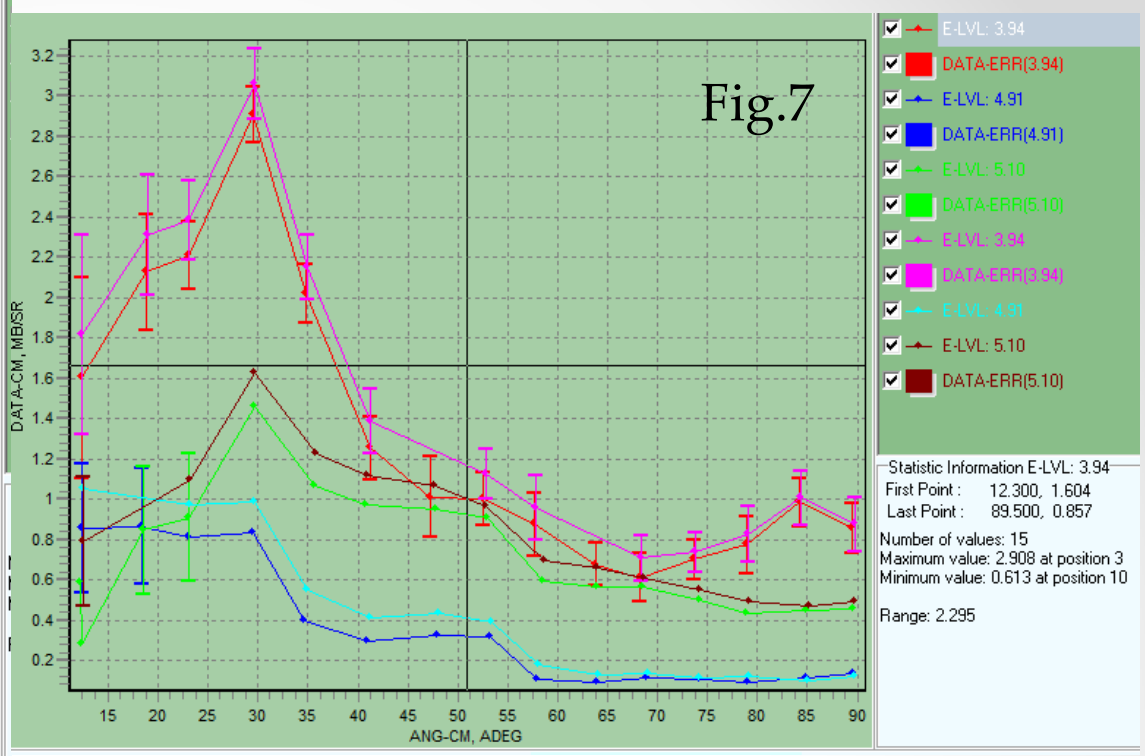


Fig.7
DATA-CM, MB/SR
ANG-CM, ADEG
E-LVL: 3.94
DATA-ERR(3.94)
E-LVL: 4.91
DATA-ERR(4.91)
E-LVL: 5.10
DATA-ERR(5.10)
E-LVL: 3.94
DATA-ERR(3.94)
E-LVL: 4.91
E-LVL: 5.10
DATA-ERR(5.10)
Statistic Information E-LVL: 3.94
First Point : 12.300, 1.604
Last Point : 89.500, 0.857
Number of values: 15
Maximum value: 2.908 at position 3
Minimum value: 0.613 at position 10
Range: 2.295

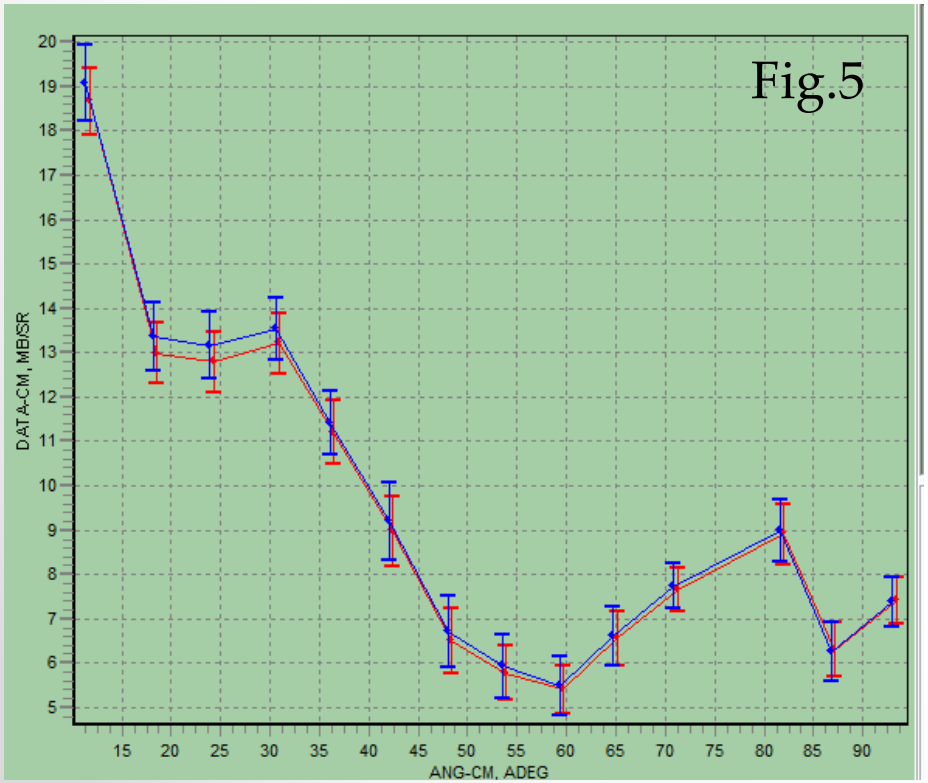


Fig.5
DATA-CM, MB/SR
ANG-CM, ADEG

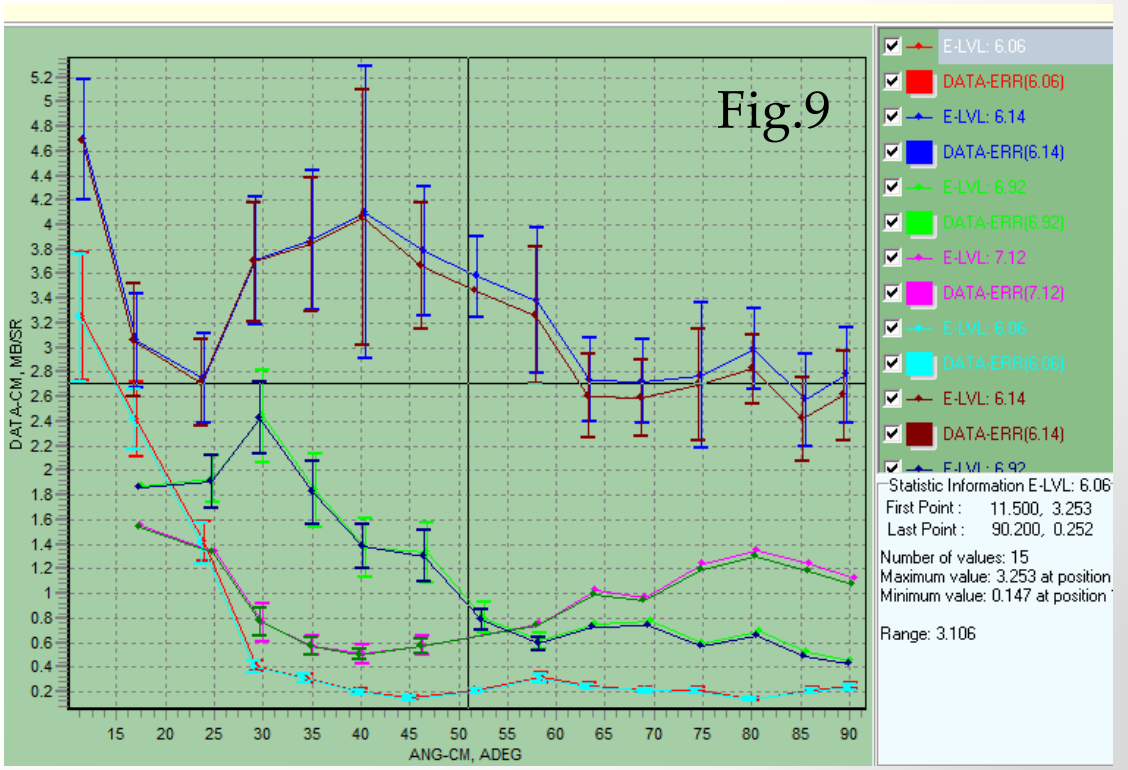
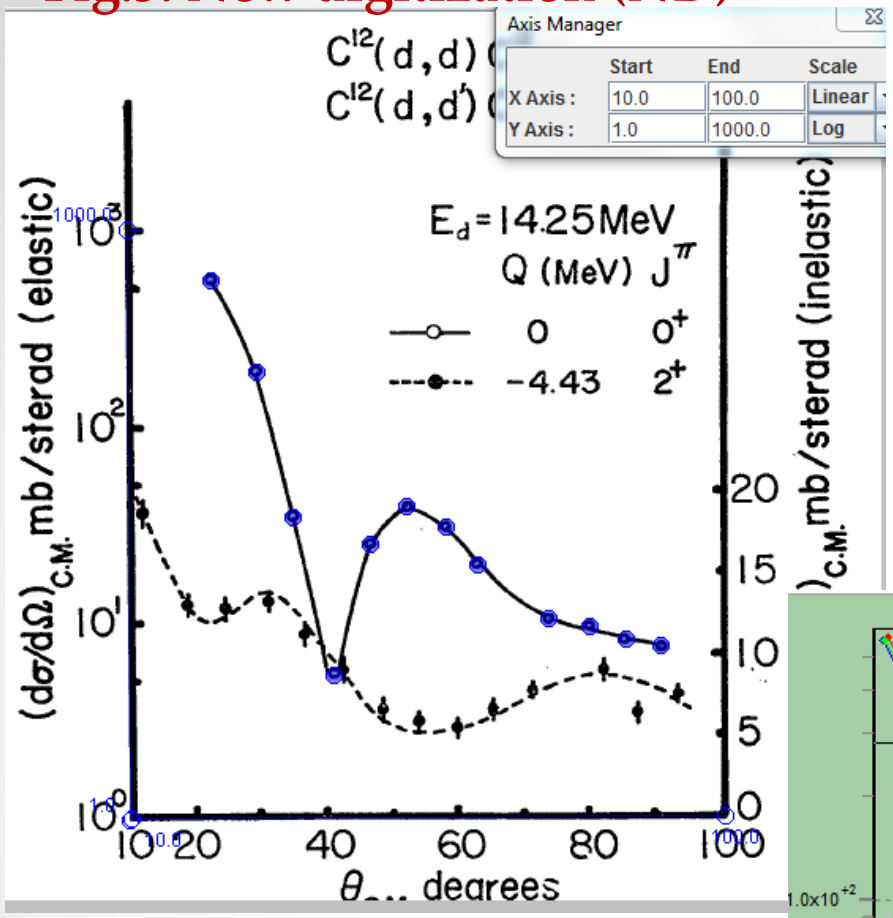


Fig.9
DATA-CM, MB/SR
ANG-CM, ADEG
E-LVL: 6.06
DATA-ERR(6.06)
E-LVL: 6.14
DATA-ERR(6.14)
E-LVL: 6.92
DATA-ERR(6.92)
E-LVL: 7.12
DATA-ERR(7.12)
E-LVL: 6.06
E-LVL: 6.14
DATA-ERR(6.14)
Statistic Information E-LVL: 6.06
First Point : 11.500, 3.253
Last Point : 90.200, 0.252
Number of values: 15
Maximum value: 3.253 at position
Minimum value: 0.147 at position
Range: 3.106

Fig.5. New digitization (ND)



Red – F0164, Blue-E2254, Green – ND
Difference between two digitization (red and green) is less than 1%
Red – ExforEditor software
Green – GSYS software
=> No difference between F0164 and ND

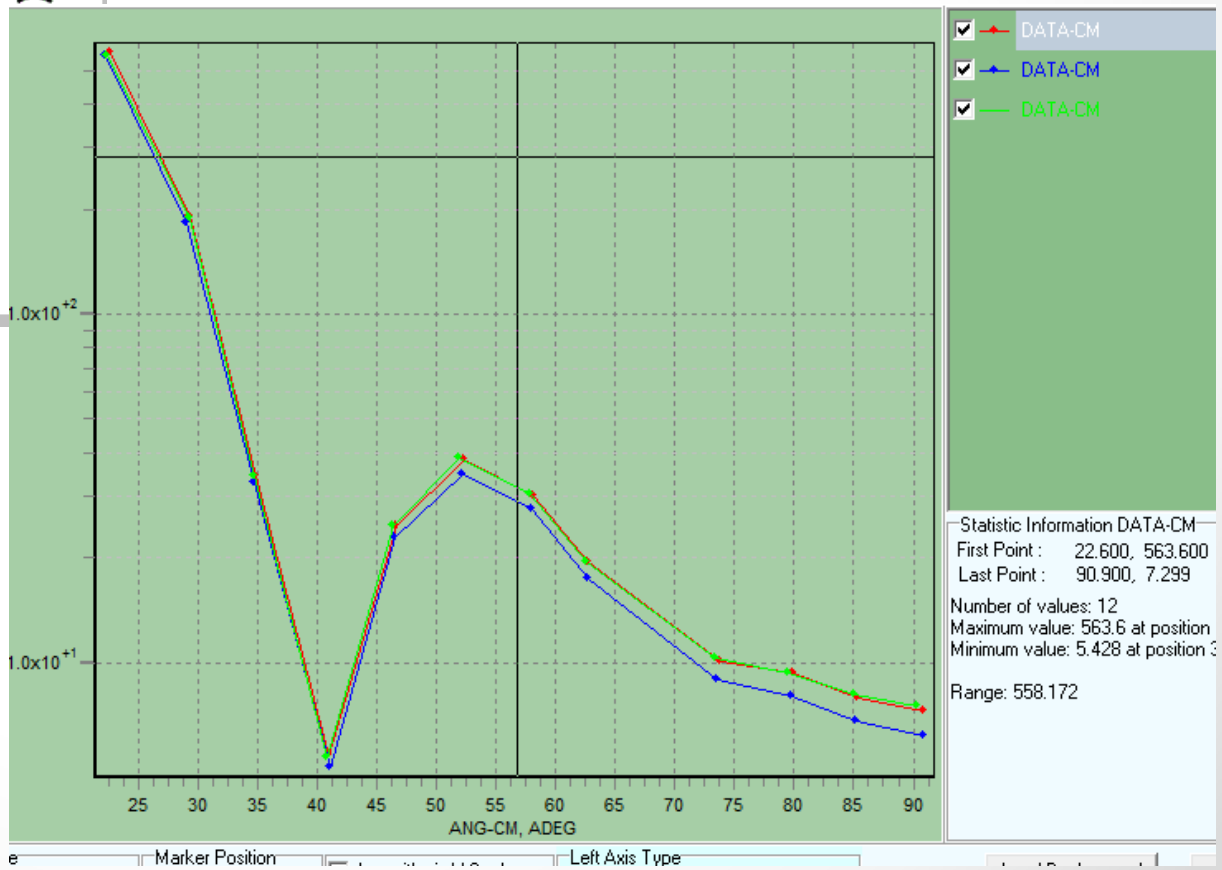
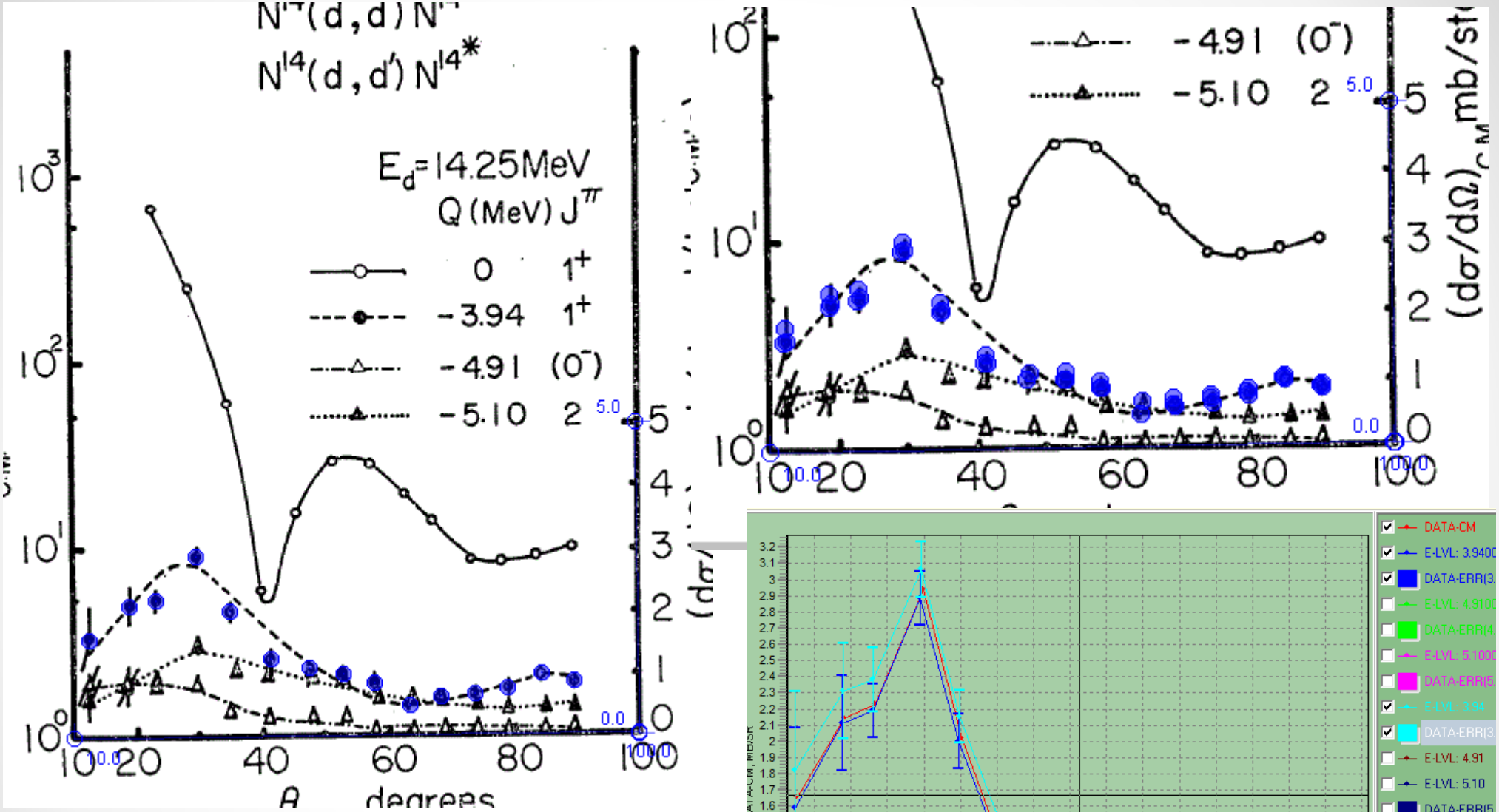


Fig.7. New digitization

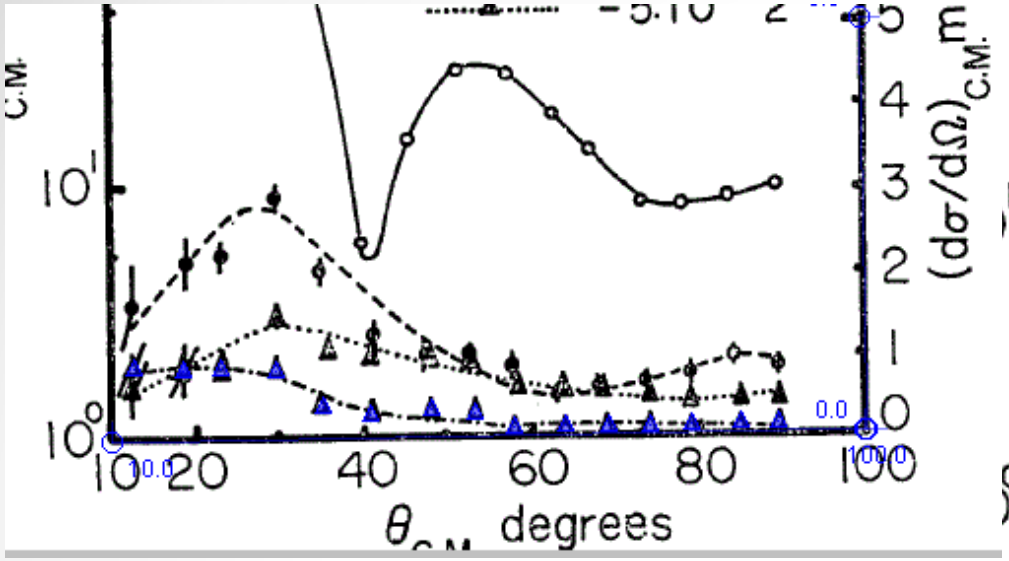
E-lvl = 3.94 MeV

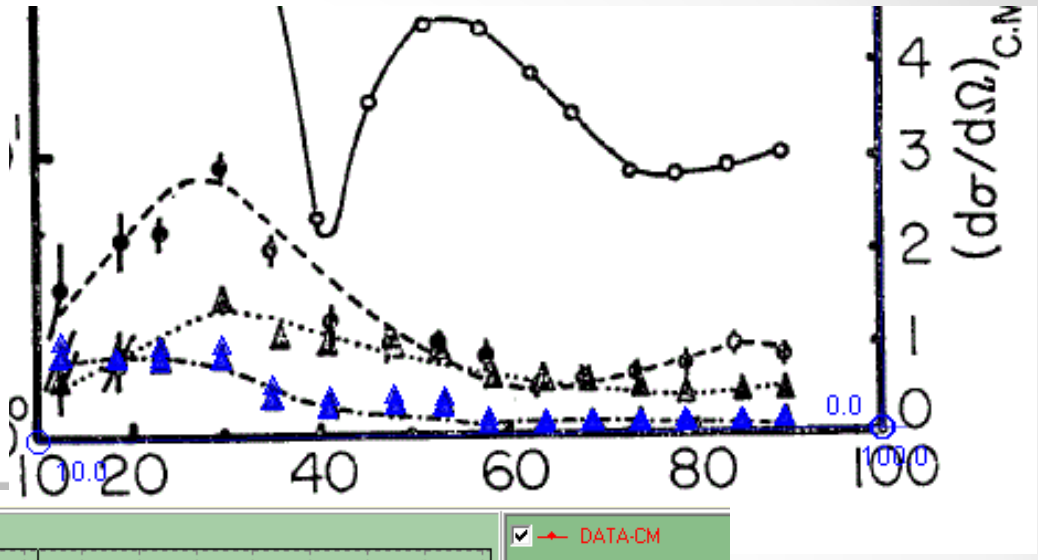


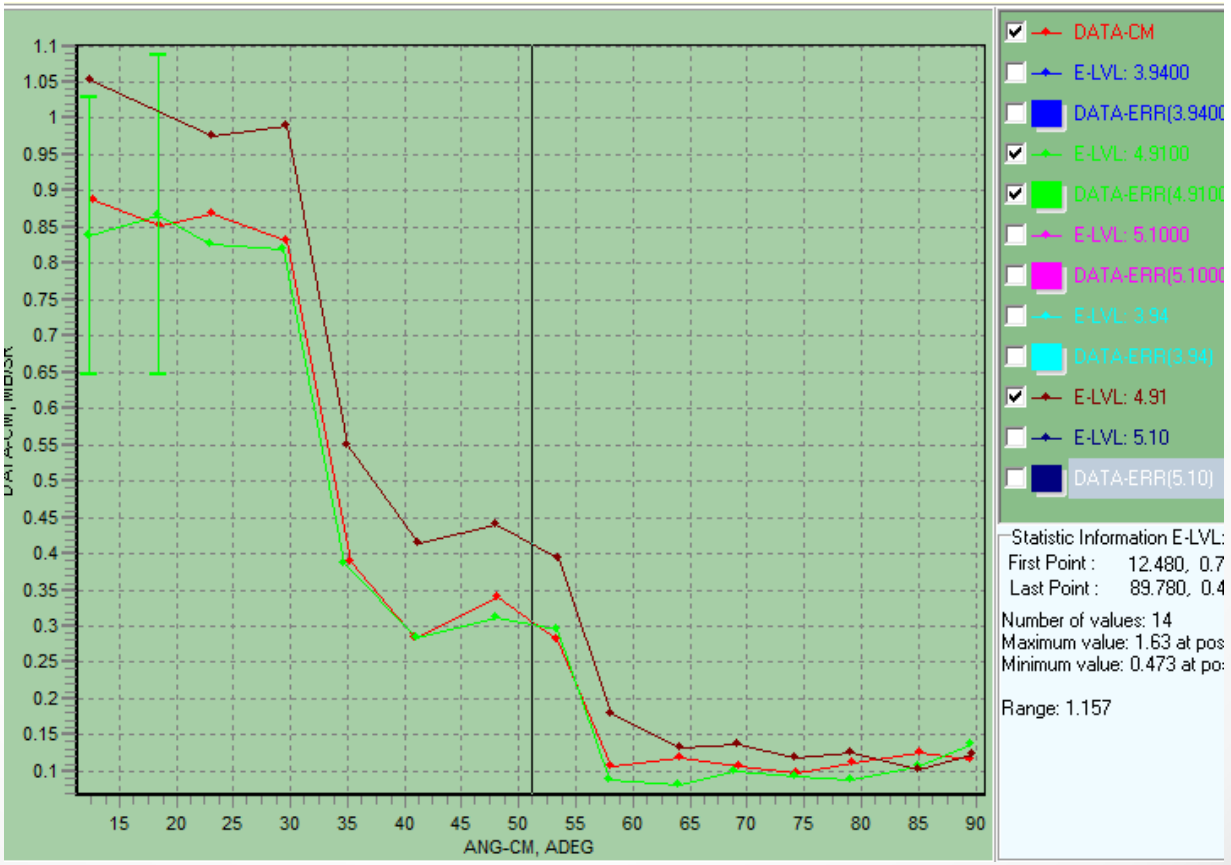
Red – F0164, Light blue-E2254, Blue – ND

=> No difference between F0164 and ND

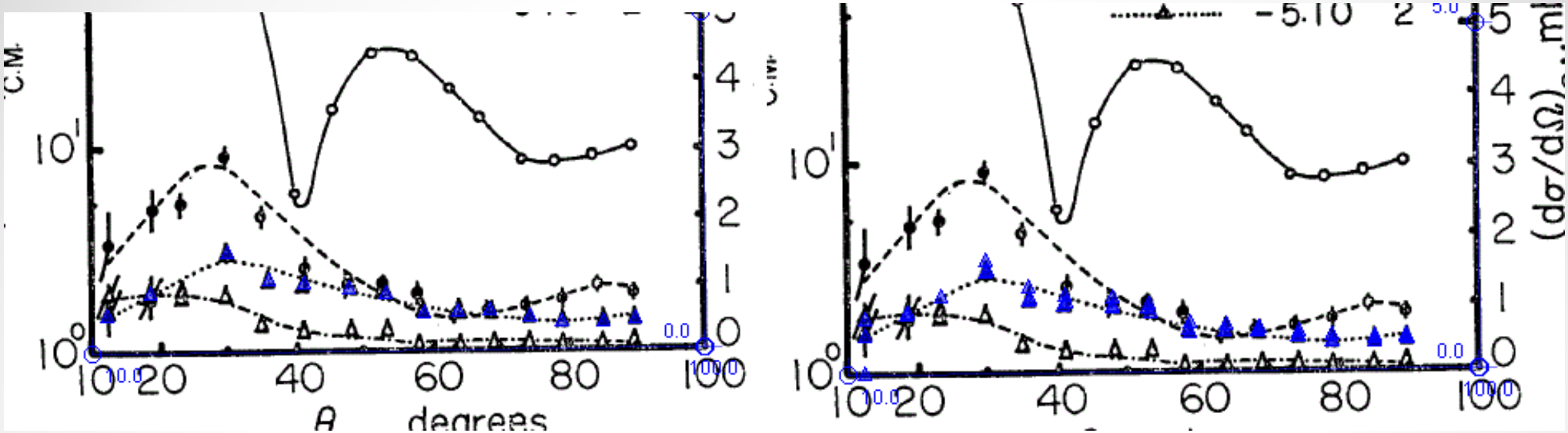
E-lvl = 4.91 MeV

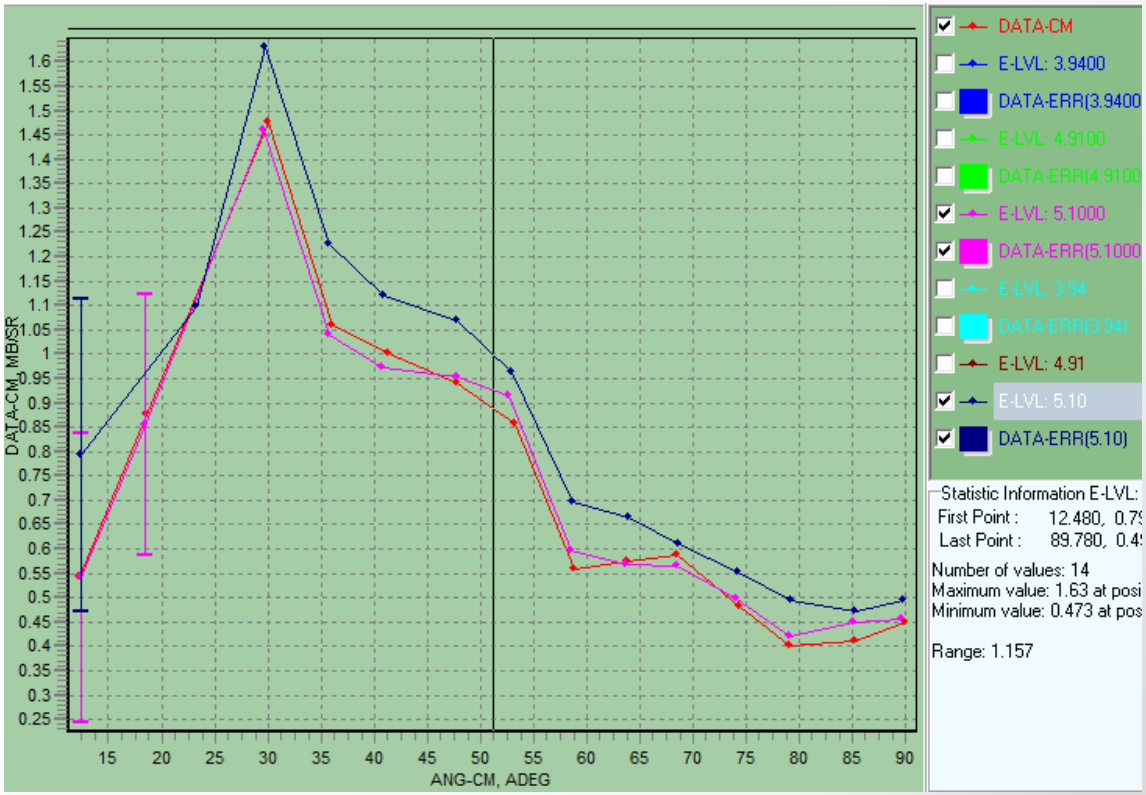

10^1
10^0
10.0
20
40
60
80
100
0.0
4
3
2
1
0
$(d\sigma/d\Omega)_{C.M.}$
$\theta_{C.M.}$ degrees


10.0
20
40
60
80
100
0.0
4
3
2
1
0
$(d\sigma/d\Omega)_{C.M.}$


1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
ANG-CM, ADEG
DATA-CM
E-LVL: 3.9400
DATA-ERR(3.9400
E-LVL: 4.9100
DATA-ERR(4.910
E-LVL: 5.1000
DATA-ERR(5.100
E-LVL: 3.94
DATA-ERR(3.94)
E-LVL: 4.91
E-LVL: 5.10
DATA-ERR(5.10)
Statistic Information E-LVL:
First Point : 12.480, 0.7
Last Point : 89.780, 0.4
Number of values: 14
Maximum value: 1.63 at pos
Minimum value: 0.473 at po:
Range: 1.157

E-lvl = 5.1 MeV


10
10
20
40
60
80
100
θ degrees
0.0
100.0
5.10
(dσ/dΩ)


DATA-CM
E-LVL: 3.9400
DATA-ERR(3.9400)
E-LVL: 4.9100
DATA-ERR(4.9100)
E-LVL: 5.1000
DATA-ERR(5.1000)
E-LVL: 3.94
DATA-ERR(3.94)
E-LVL: 4.91
E-LVL: 5.10
DATA-ERR(5.10)
Statistic Information E-LVL:
First Point : 12.480, 0.7
Last Point : 89.780, 0.4
Number of values: 14
Maximum value: 1.63 at posi
Minimum value: 0.473 at pos
Range: 1.157
DATA-CM, MB/SR
ANG-CM, ADEG

Accuracy depends on:

- ***Digitization system resolution? => no***

resolution is almost the same (Nowadays, a scanner is used for digitization, the resolution of which is on average 300 - 600 dpi.)

- ***Accuracy of scale input and its selection? yes***
- ***Personal error? yes***

Let us check dependence on scale.

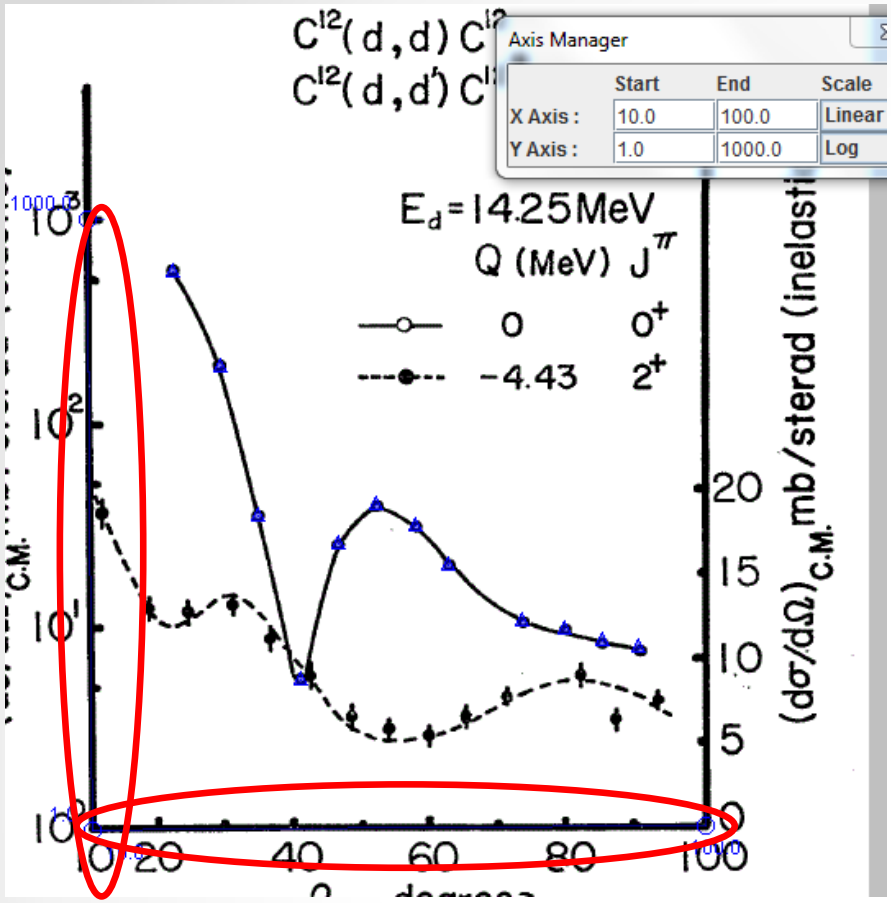
Dataset was digitized with scale marks at:

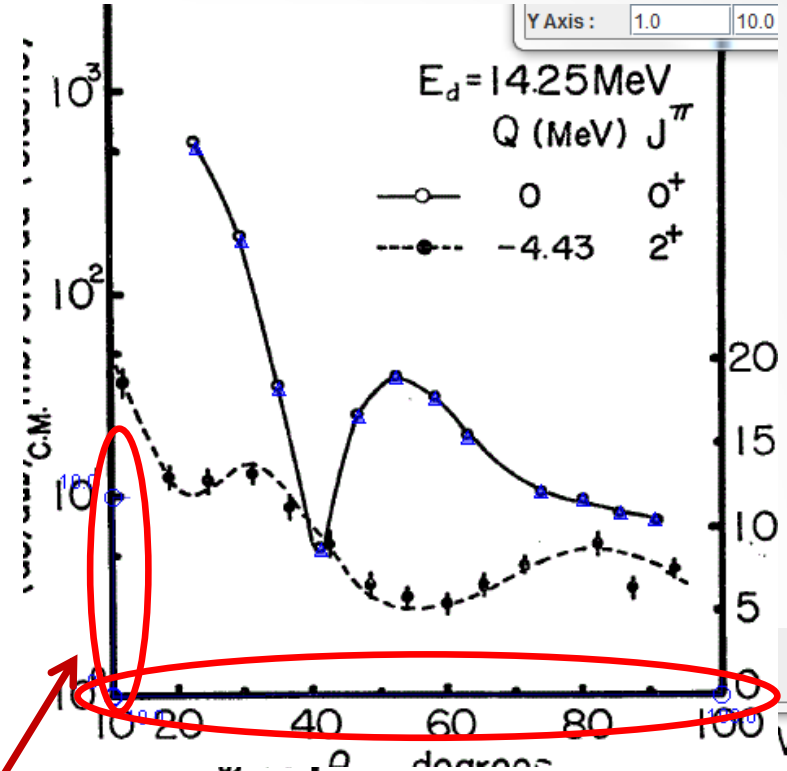
x: 10, 100 ang.;

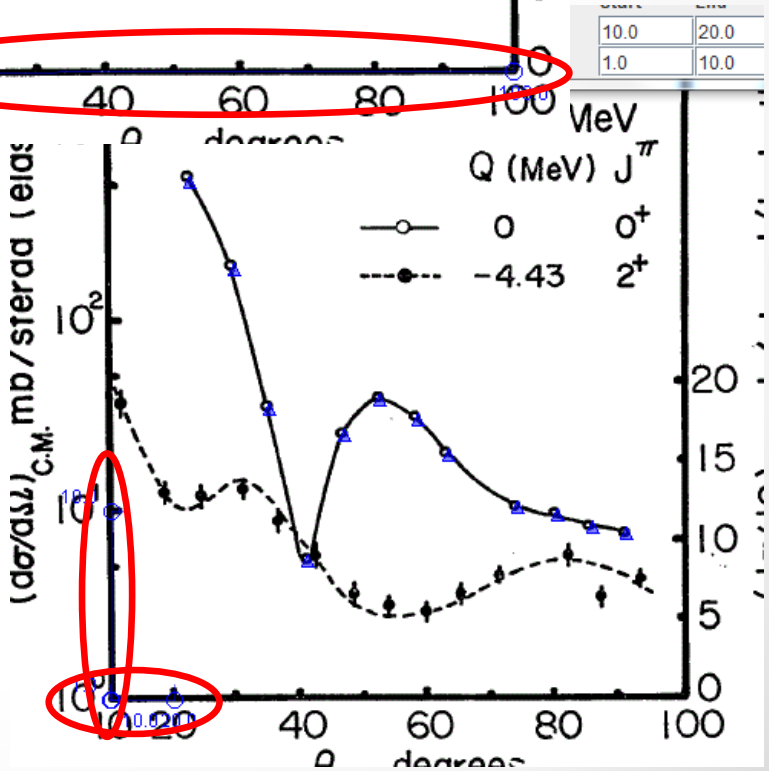
y: 1., 1000.

Then the same dataset was presented on the figure using another scale marks.

Scale dependence

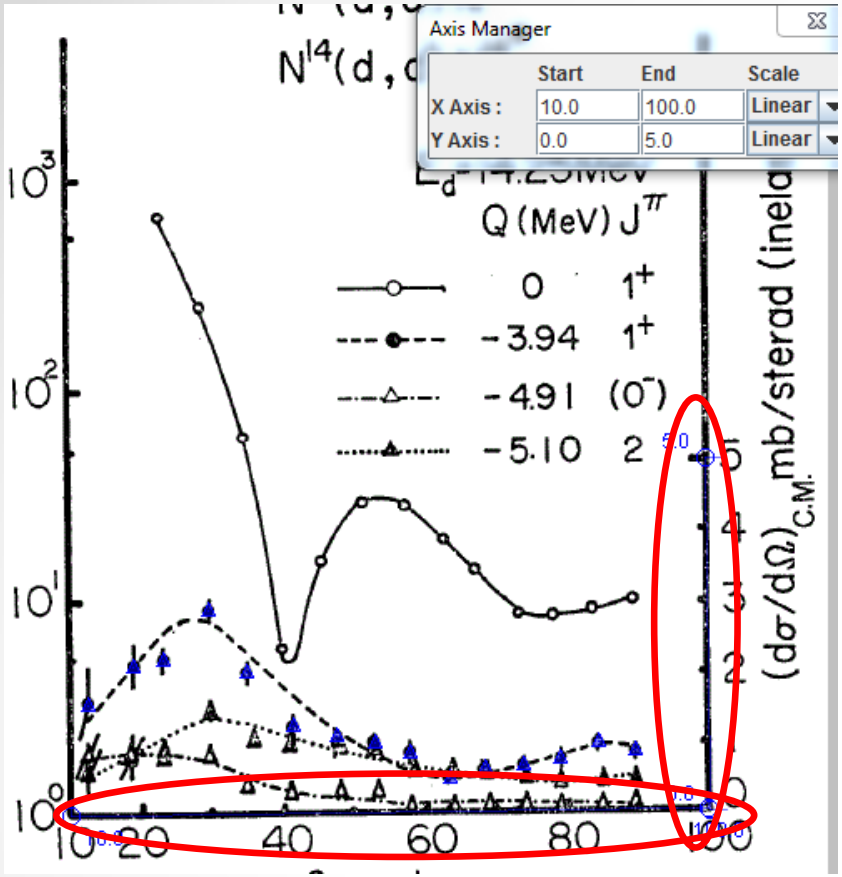


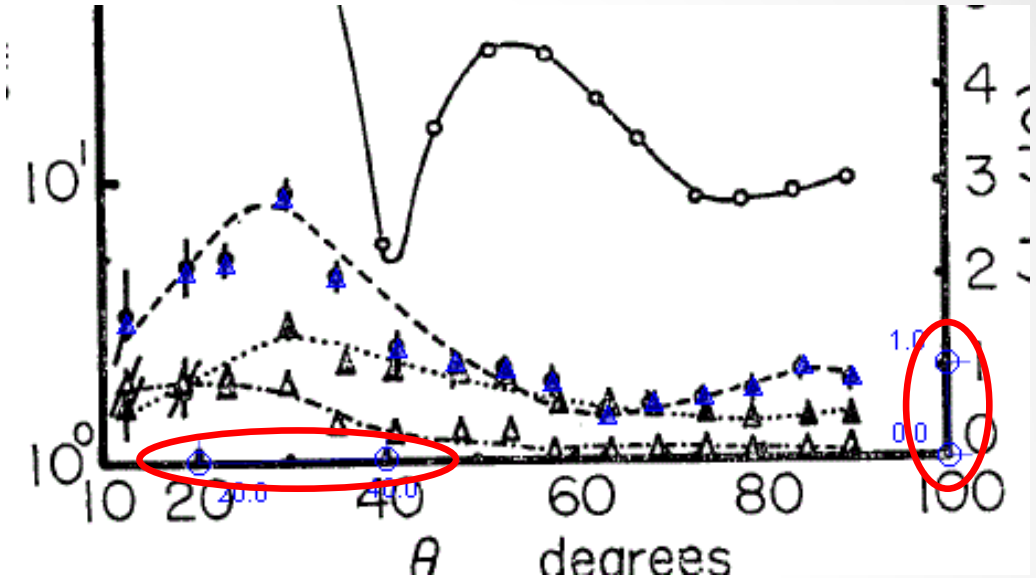


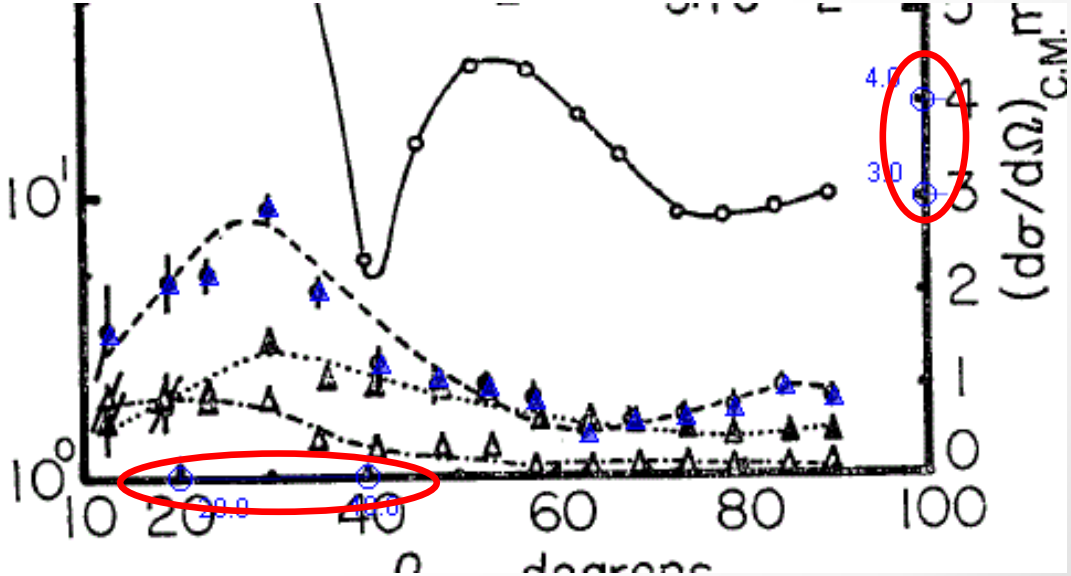


Scale dependence can be seen on these figures. Scale marks were input in different points.

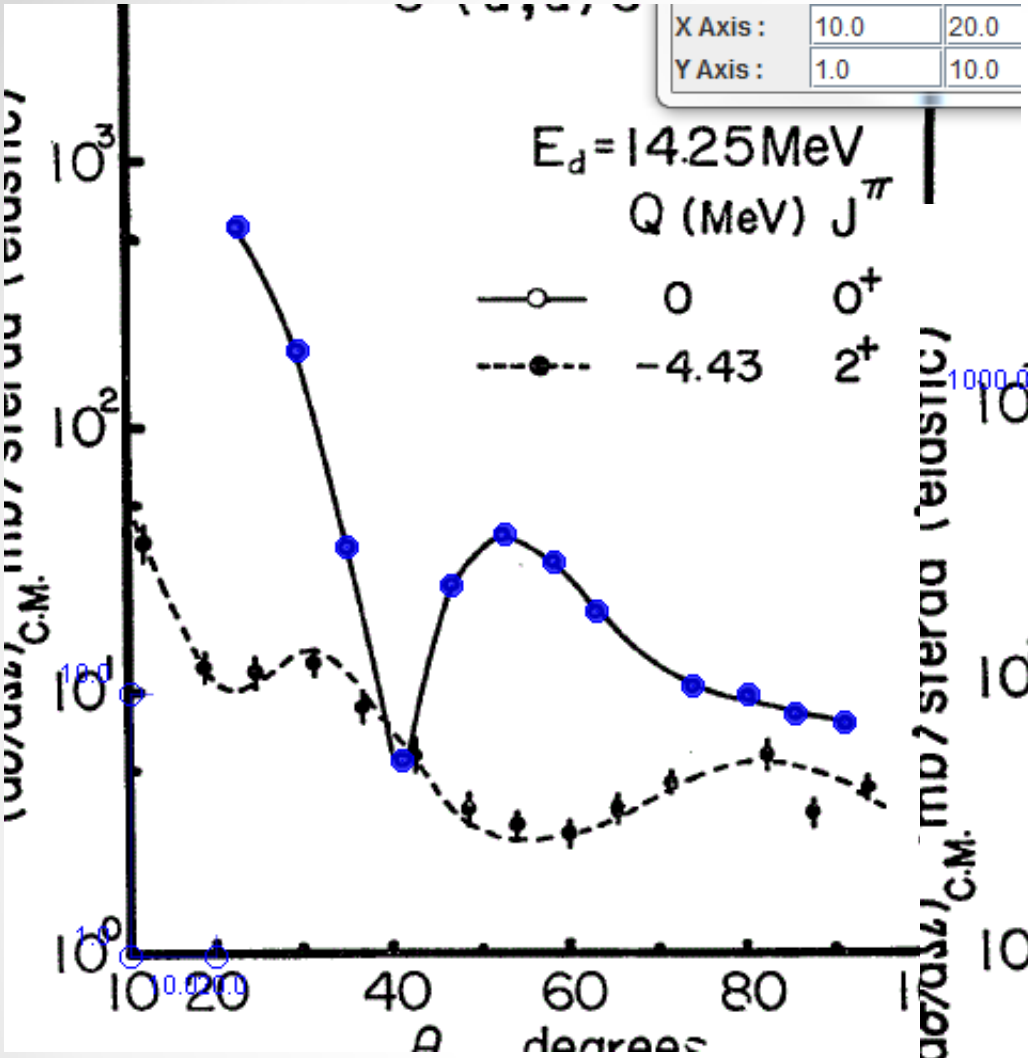
Scale dependence



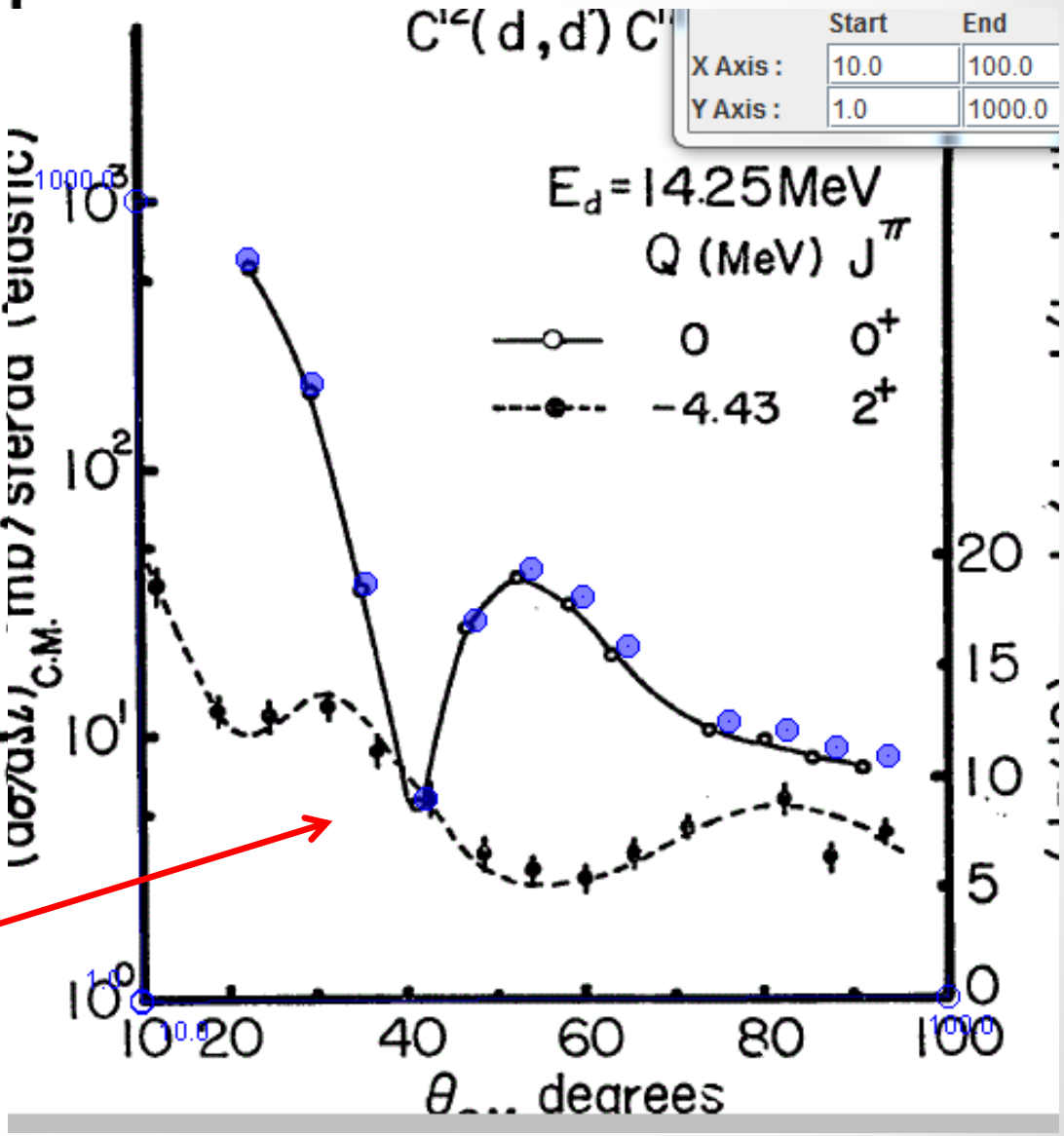




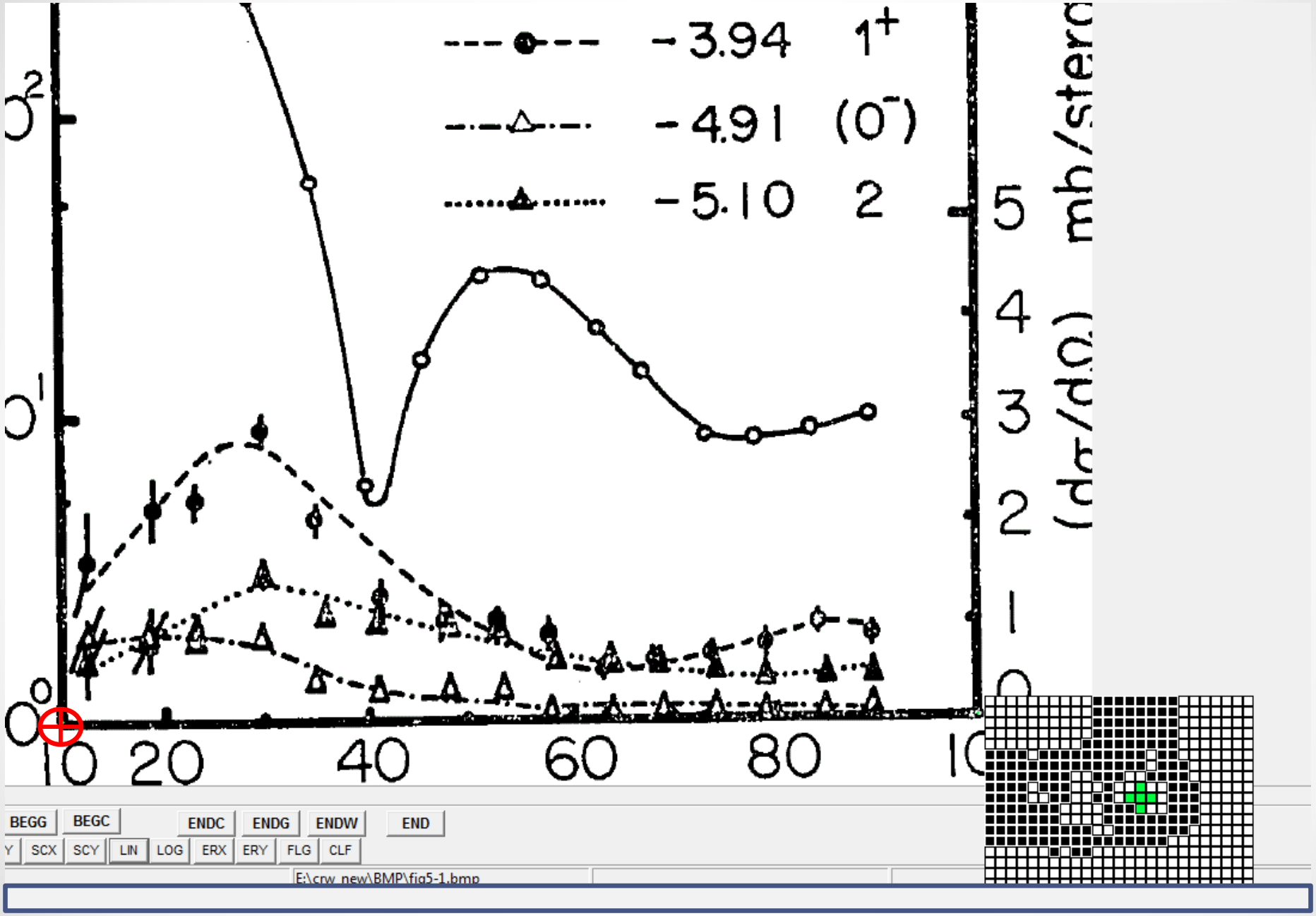
Another example: Dataset was digitized with scale marks:
x: 10, 20 ang.; y: 1., 10.



Then dataset was presented on figure using another scale marks.



Scale marks


-3.94 1+
-4.91 (0-)
-5.10 2
mb/ster
(dσ/dΩ)
0
1
2
3
4
5
10
20
40
60
80
BEGG
BEGC
ENDC
ENDG
ENDW
END
SCX
SCY
LIN
LOG
ERX
ERY
FLG
CLF
E:\crw_new\BMP\fig5-1.bmp

Conclusions

- *1. Accuracy of digitizing slightly depends on software (GSYS or InpGraph).*
- *2. Compiler should pay attention to scale mark digitizing. The dataset have to be between the first and the last scale marks (it is important especially for old figures).*
- *See https://www-nds.iaea.org/nrdc/nrdc_sft/digitization/*

Remarks:

1. Unfortunately, in GSYS I didn't find possibility to show different datasets using different colors.

2. It will be nice, if it will be possible to use crosses inside of circles for scale marks